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ABSTRACT

This manual is the third of a three-text microcomputer service and repair series. This text is designed to assist instructors in teaching service and repair procedures for floppy disk drives, printers, and monitors. The manual contains five units. Each instructional unit includes some or all of these basic components: performance objectives, suggested activities for teachers and students, information sheets, assignment sheets, job sheets, visual aids, tests, and answers to the tests. Units are planned for more than one lesson or class period of instruction. Topics covered in the units are introduction to peripheral repair, and servicing and repairing dot-matrix printers and letter-quality printers, computer monitors, and floppy disk drives. (KC)

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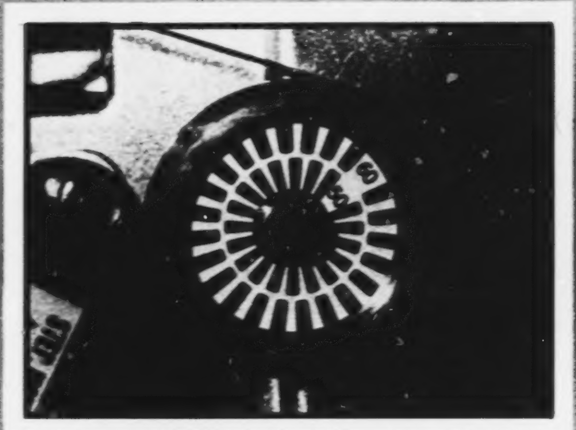

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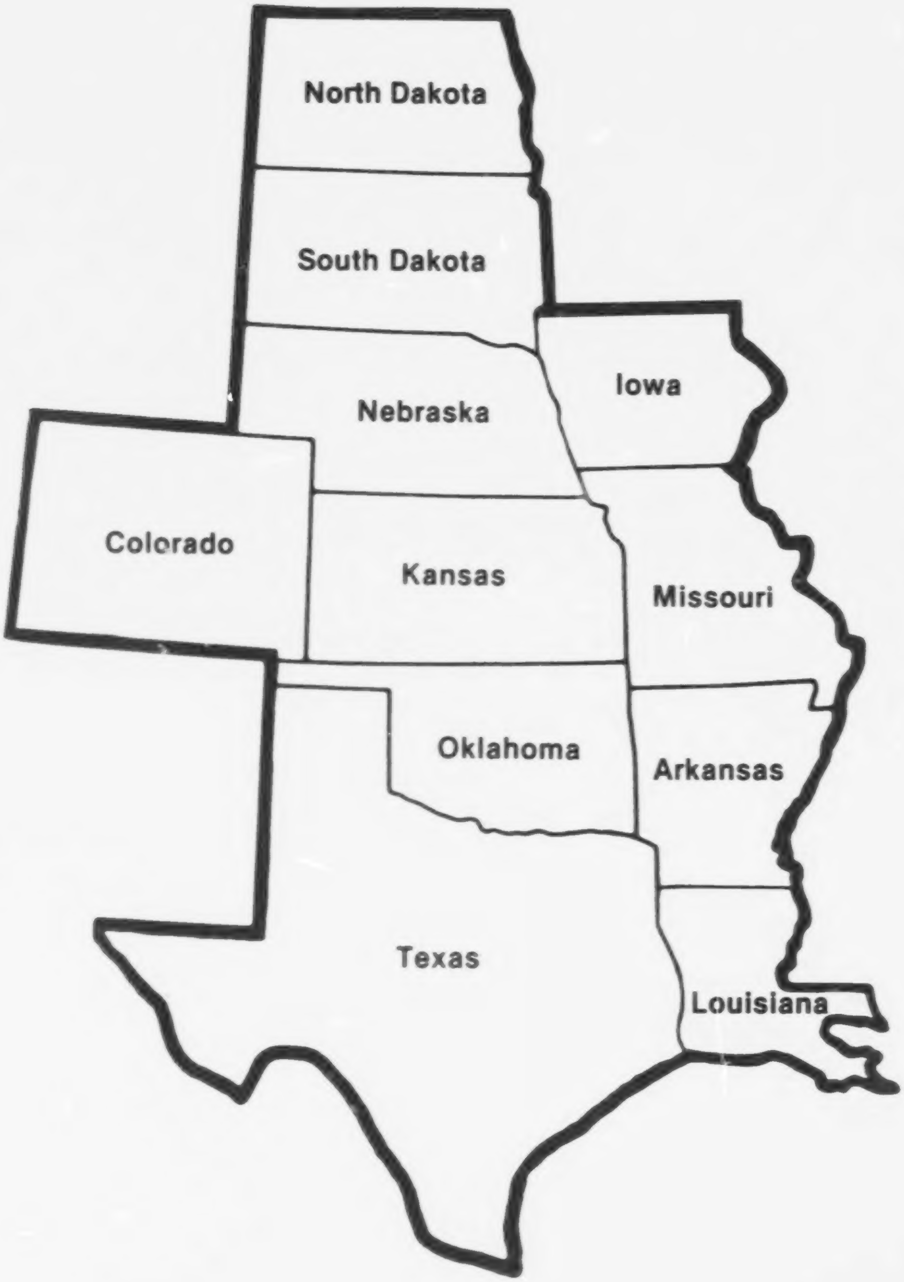
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MICROCOMPUTER PERIPHERAL SERVICE TECHNICIAN

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MICROCOMPUTER PERIPHERAL SERVICE TECHNICIAN

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Introductory pages xxix through xxxiv include important information about schematics and other graphic aids recommended for troubleshooting printers, monitors, and floppy disk drives — be sure to read that information!

FOREWORD

Department of Labor statistics forecast a bright future for microcomputer service technicians, so the future for microcomputer peripheral service technicians should be even brighter. The reason a good peripheral service tech will probably have a good job is simple — peripherals malfunction more often then microcomputers and other parts of a microcomputer system do.

Generally, the highest malfunction rate is with floppy disk drives with printers running a close second. Computer monitors are not in the high-fail category, but a good peripheral service technician should have monitor repair skills, too. Well rounded skills get technicians better jobs.

The electromechanical elements in peripheral repair pose a special problem to technicians. That is why so much of this text is dedicated to a do-it-by-the-numbers approach to systematic troubleshooting. We were fortunate that Okidata permitted us to use their excellent materials for the unit on dot-matrix printers, and equally as fortunate that Star Micronics permitted us to use their fine materials for the unit on letter-quality printers. The detailed illustrations in the printer units should serve as a guide for printers in general and give students a better concept of electromechanical/electronic relationships in peripherals.

We have a feeling that electronics instructors have been looking for a text like *Microcomputer Peripheral Service Technician.* It will provide basic students an opportunity to add to their job-getting skills and give advanced technicians a challenging area in which to specialize.

James Dasher, Chairman
Board of Directors
Mid-America Vocational
Curriculum Consortium

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PREFACE

Microcomputer Peripheral Service Technician is the third of MAVCC's three-text microcomputer service and repair series. It fits rather naturally with *Basic Microcomputer Service Technician* and with *Advanced Microcomputer Service Technician*. In other words, it's natural for a basic student to want to expand his or her job skills and just as natural for advanced students to want to specialize.

If you haven't examined MAVCC's *Basic* and *Advanced* books, you should send for them. The trio of texts are designed to assist electronics instructors in planning and executing much-needed programs in both microcomputer and peripheral repair.

High tech jobs are waiting for students who master the skills presented in MAVCC's microcomputer repair series. If your electronics program is lacking materials, contact MAVCC. We've got the triple-threat curriculum to help you produce winners.

Greg Pierce
Executive Director
Mid-America Vocational
Curriculum Consortium

ACKNOWLEDGEMENTS

Appreciation is extended to the many individuals who contributed their time and expertise to the successful development of *Microcomputer Peripheral Service Technician*. The Resource Committee which planned and approved the text included outstanding electronics instructors from MAVCC member states, representatives from the microcomputer service industry, and even a computer store owner. A special thank you goes to the members of the Resource Committee:

Charles Black, Shreveport-Bossier Vo-Tech, Shreveport, Louisiana
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Gus Rummel, Central Texas College, Killeen, Texas
Ron Vorderstrasse, Central Community College, Columbus, Nebraska

Another special thank you goes to **Dr. A. O. Brown III** of Pittsburg, Kansas, for a splendid job of writing the text and also for his contributions as a member of the Resource Committee.

Appreciation is also extended to Dan Fulkerson, MAVCC's Publications Coordinator, for his contributions as editor of the project, and to Mary Kellum and Jane Huston of MAVCC for editing assistance.

A special appreciation goes out to Damon Davis and to the publishers Howard W. Sams & Co., Inc., for their active support of the project and for materials contributed to the project.

A concluding thank you goes to many people in the industry who took time to talk to the writer and editorial staff on the phone, and to assist with other technical matters in correspondence. Engineers, Service Managers, and Customer Service personnel from many companies are among the list that is too numerous to include here, but a collective thank you goes to all of them.

The text was phototypeset in the Oklahoma State Vo-Tech Communications Center, and for her dedicated contribution, appreciation is extended to the phototypesetter Leslie Mathis.

Another vote of thanks goes to the personnel of the Oklahoma State Vo-Tech Print Shop for their excellent work in printing the text.

USE OF THIS PUBLICATION

Instructional Units

Microcomputer Peripheral Service Technician includes five units. Each instructional unit includes some or all of the basic components of a unit of instruction; performance objectives, suggested activities for teachers and students, information sheets, assignment sheets, job sheets, visual aids, tests, and answers to the tests. Units are planned for more than one lesson or class period of instruction.

Careful study of each instructional unit by the teacher will help to determine:

A. The amount of material that can be covered in each class period
B. The skills which must be demonstrated

    1. Supplies needed
    2. Equipment needed
    3. Amount of practice needed
    4. Amount of class time needed for demonstrations

C. Supplementary materials such as pamphlets or filmstrips that must be ordered
D. Resource people who must be contacted

Objectives

Each unit of instruction is based on performance objectives. These objectives state the goals of the course, thus providing a sense of direction and accomplishment for the student.

Performance objectives are stated in two forms: unit objectives, stating the subject matter to be covered in a unit of instruction; and specific objectives, stating the student performance necessary to reach the unit objective.

Since the objectives of the unit provide direction for the teaching-learning process, it is important for the teacher and students to have a common understanding of the intent of the objectives. A limited number of performance terms have been used in the objectives for this curriculum to assist in promoting the effectiveness of the communication among all individuals using the materials.

Reading of the objectives by the student should be followed by a class discussion to answer any questions concerning performance requirements for each instructional unit.

Teachers should feel free to add objectives which will fit the material to the needs of the students and community. When teachers add objectives, they should remember to supply the needed information, assignment and/or job sheets, and criterion tests.

Suggested Activities for the Instructor

Each unit of instruction has a suggested activities sheet outlining steps to follow in accomplishing specific objectives. Duties of instructors will vary according to the particular unit; however, for best use of the material they should include the following: provide students with objective sheet, information sheet, assignment sheets, and job sheets; preview filmstrips, make transparencies, and arrange for resource materials and people; discuss unit and specific objectives and information sheet; give test. Teachers are encouraged to use any additional instructional activities and teaching methods to aid students in accomplishing the objectives.

Information Sheets

Information sheets provide content essential for meeting the cognitive (knowledge) objectives in the unit. The teacher will find that the information sheets serve as an excellent guide for presenting the background knowledge necessary to develop the skill specified in the unit objective.

Students should read the information sheets before the information is discussed in class. Students may take additional notes on the information sheets.

Transparency Masters

Transparency masters provide information in a special way. The students may see as well as hear the material being presented, thus reinforcing the learning process. Transparencies may present new information or they may reinforce information presented in the information sheets. They are particularly effective when identification is necessary.

Transparencies should be made and placed in the notebook where they will be immediately available for use. Transparencies direct the class's attention to the topic of discussion. They should be left on the screen only when topics shown are under discussion.

Assignment Sheets

Assignment sheets give direction to study and furnish practice for paper and pencil activities to develop the knowledge which is a necessary prerequisite to skill development. These may be given to the student for completion in class or used for homework assignments. Answer sheets are provided which may be used by the student and/or teacher for checking student progress.

Job Sheets

Job sheets are an important segment of each unit. The instructor should be able to demonstrate the skills outlined in the job sheets. Procedures outlined in the job sheets give direction to the skill being taught and allow both student and teacher to check student progress toward the accomplishment of the skill. Job sheets provide a ready outline for students to follow if they have missed a demonstration. Job sheets also furnish potential employers with a picture of the skills being taught and the performances which might reasonably be expected from a person who has had this training.

Test and Evaluation

Paper-pencil and performance tests have been constructed to measure student achievement of each objective listed in the unit of instruction. Individual test items may be pulled out and used as a short test to determine student achievement of a particular objective. This kind of testing may be used as a daily quiz and will help the teacher spot difficulties being encountered by students in their efforts to accomplish the unit objective. Test items for objectives added by the teacher should be constructed and added to the test.

Test Answers

Test answers are provided for each unit. These may be used by the teacher and/or student for checking student achievement of the objectives.

MICROCOMPUTER PERIPHERAL SERVICE TECHNICIAN

INSTRUCTIONAL/TASK ANALYSIS

JOB TRAINING: What the Worker Should Be Able to Do (Psychomotor)	RELATED INFORMATION: What the Worker Should Know (Cognitive)
UNIT I: INTRODUCTION TO PERIPHERAL REPAIR	
	1. Terms and definitions
	2. General categories or peripherals and their characteristics
	3. Troubleshooting requirements for peripherals
	4. Perspectives on electromechanical repair
	5. Aspects of electromechanical troubleshooting
	6. Dirt and electromechanical devices
	7. Vibration and electromechanical devices
	8. Improper use of electromechanical devices
	9. Lubrication of electromechanical devices
	10. Safety interlocks on electromechanical devices
	11. Special tools for electromechanical devices
	12. Guidelines for troubleshooting floppy disk drives and printers
	13. Guidelines for successful computer monitor repair
14. Recommend solutions to peripheral repair problems	

JOB TRAINING: What the
Worker Should Be Able to Do
(Psychomotor)

RELATED INFORMATION: What
the Worker Should Know
(Cognitive)

UNIT II: SERVICING AND REPAIRING DOT-MATRIX PRINTERS

1. Terms and definitions
2. Design features of the Microline 92 (ML92) dot-matrix printer
3. ML92 electronic controls and their functions
4. ML92 mechanical controls and their functions
5. ML92 selection and protection controls and their functions
6. Printhead operation on the ML92
7. ML92 printhead characteristics
8. Spacing and carriage operations on the ML92
9. Ribbon feed operations on the ML92
10. Paper feed operations on the ML92
11. Paper-out detection devices on the ML92
12. Printhead gap adjustment on the ML92
13. Control board features of the ML92
14. Motor specifications on the ML92
15. Protective devices on the ML92
16. Steps in initializing the ML92
17. The operating cycle in an ML92
18. Some ML92 problems and suggested solutions
19. ML92 interfaces

JOB TRAINING: What the Worker Should Be Able to Do (Psychomotor)	RELATED INFORMATION: What the Worker Should Know (Cognitive)
20. Install paper feeding devices on an ML92 printer	
21. Remove the upper case on an ML92 printer and replace the system fuse	
22. Replace a ribbon and install cut-sheet, roll, and sprocket-fed paper on an ML92 printer	
23. Operate an ML92 printer to check control functions and run a printer self test	
24. Make tension and gap adjustments on an ML92 printer	
25. Remove and replace major components of an ML92 printer	
26. Troubleshoot an ML92 printer when the printhead does not move at power-up	
27. Troubleshoot an ML92 printer when the carriage keeps running right or left at power-up	
28. Troubleshoot an ML92 printer when the carriage vibrates at power-up	
29. Troubleshoot an ML92 printer when the circuit breaker opens at power-up	
30. Troubleshoot an ML92 printer when printing or spacing operations do not start with data input	
31. Troubleshoot an ML92 printer when the printer spaces but will not print	
32. Troubleshoot an ML92 printer when the printer prints but will not space	
33. Troubleshoot an ML92 printer when the printhead will not return to home after printing	
34. Troubleshoot an ML92 printer when it will not perform line feed functions	
35. Troubleshoot an ML92 printer when the paper-out detector is not working	

JOB TRAINING: What the Worker Should Be Able to Do (Psychomotor)

RELATED INFORMATION: What the Worker Should Know (Cognitive)

36. Troubleshoot an ML92 printer when some characters are not printed and other characters are printed wrong
37. Troubleshoot an ML92 printer when some dots in the matrix are not printed
38. Troubleshoot an ML92 printer for an open circuit breaker
39. Troubleshoot an ML92 printer when the system fuse blows
40. Troubleshoot an ML92 printer when the switches on the operation panel will not work
41. Troubleshoot an ML92 printer when the print is not dark enough

UNIT III: SERVICING AND REPAIRING LETTER-QUALITY PRINTERS

1. Terms and definitions
2. Major components of a PowerType letter-quality printer
3. PowerType control buttons and display lamps and their functions
4. PowerType slide switches and their functions
5. Setting DIP switches on a PowerType printer
6. The PowerType parallel interface connector
7. The PowerType serial interface connector
8. PowerType logic, drive, and power supply connectors
9. Printing modes on a PowerType
10. PowerType detection mechanisms and their functions

JOB TRAINING: What the Worker Should Be Able to Do (Psychomotor)	RELATED INFORMATION: What the Worker Should Know (Cognitive)
	11. PowerType alarms and their meanings
	12. Steps in cleaning a PowerType printer
13. Unpack, set up, and run a printer self test on a PowerType printer	
14. Remove and replace the upper case, cover open detector, and printer cover on a PowerType printer	
15. Remove and replace the control panel board on a PowerType printer	
16. Remove and replace the control drive board on a PowerType printer	
17. Remove and replace the control logic board on a PowerType printer	
18. Remove and replace the power regulator unit and the power supply unit on a PowerType printer	
19. Remove and replace the printer mechanism on a PowerType printer	
20. Remove and replace the paper feed assembly on a PowerType printer	
21. Remove and replace the carriage motor assembly on a PowerType printer	
22. Remove and replace the ribbon feed motor assembly on a PowerType printer	
23. Remove and replace the hammer unit on a PowerType printer	
24. Remove and replace the carriage stay on a PowerType printer	
25. Remove and replace the carriage assembly on a PowerType printer	
26. Remove and replace the platen cover and platen assembly on a PowerType printer	

JOB TRAINING: What the Worker Should Be Able to Do (Psychomotor)	RELATED INFORMATION: What the Worker Should Know (Cognitive)
27. Remove and replace the paper chute on a PowerType printer	
28. Remove and replace the bail roller assembly on a PowerType printer	
29. Remove and replace the terminal board on a PowerType printer	
30. Remove and replace the printwheel home position detector on a PowerType printer	
31. Remove and replace the carriage home position detector on a PowerType printer	
32. Remove and replace the right end detector on a PowerType printer	
33. Remove and replace the ribbon end detector on a PowerType printer	
34. Remove and replace the primary and secondary fuses on a PowerType printer	
35. Make a mutual adjustment of the hammer and printwheel on a PowerType printer	
36. Make a position adjustment of the printwheel home position detector on a PowerType printer	
37. Adjust the platen position, idler gear backlash, and paper pressure/platen gap on a PowerType printer	
38. Adjust the timing belt tension on a PowerType printer	
39. Adjust the carriage home position detector on a PowerType printer	
40. Adjust the carriage right end detector on a PowerType printer	
41. Adjust the ribbon cable on a PowerType printer	
42. Adjust the power supply voltage on a PowerType printer	
43. Troubleshoot a PowerType printer for control problems	

UNIT IV: SERVICING AND REPAIRING COMPUTER MONITORS

JOB TRAINING: What the Worker Should Be Able to Do (Psychomotor)	RELATED INFORMATION: What the Worker Should Know (Cognitive)
	1. Terms and definitions
	2. Prerequisites recommended for monitor service technicians
	3. Hazards and dangers of working with CRT's
	4. General characteristics of computer monitors
	5. Sections of a monitor
	6. Types of monitors
	7. Modular structure in a typical RGB monitor
	8. The high voltage and horizontal sweep module
	9. Steps in the formation of a color CRT picture
	10. The importance of convergence in RGB monitors
	11. How a CRT yoke works
	12. How a standard television scanning pattern works
	13. Monitor control devices
14. Use a CRT display to evaluate monitor problems	
15. Discharge high voltage from a CRT and make a sensory check of the monitor	
16. Check the power supply and operating voltages on a monitor	
17. Troubleshoot monitor picture problems related to voltage	

JOB TRAINING: What the Worker Should Be Able to Do (Psychomotor)

RELATED INFORMATION: What the Worker Should Know (Cognitive)

18. Check the sweep signal on a color monitor

19. Troubleshoot RGB and monochrome signals on a computer monitor

UNIT V: SERVICING AND REPAIRING FLOPPY DISK DRIVES

1. Terms and definitions
2. Keys to successful floppy disk drive repair
3. Disk drive controllers
4. The dynamics of reading from or writing to a floppy disk
5. How a microcomputer uses a program from disk
6. Control activities in floppy disk formatting
7. Typical steps in formatting a floppy disk
8. How tracks and sectors are selected
9. System detectors and their functions
10. Electromechanical subsystem components and their functions
11. Electrical subsystems and their general functions
12. Specific control functions of the electrical subsystems
13. Special tools recommended for repairing disk drives
14. Cable and connector trouble spots
15. Technical and graphic materials required for troubleshooting

JOB TRAINING: What the Worker Should Be Able to Do (Psychomotor)	RELATED INFORMATION: What the Worker Should Know (Cognitive)
	16. Cost factors important in disk drive repair
	17. Typical diagnostic disk tests and their functions
	18. Guidelines for troubleshooting faulty disk drives
19. Validate a floppy disk drive failure	
20. Troubleshoot, clean, lubricate, and prepare a floppy disk drive for adjustments	
21. Adjust speed and align the head on a floppy disk drive	

MICROCOMPUTER PERIPHERAL SERVICE TECHNICIAN

Tools, Equipment, and Materials List

Set of Phillips screwdrivers
Set of flat-blade screwdrivers
Slip-joint pliers
Side-cutting pliers
Hexagonal wrench set
5.5 mm wrench
11 mm wrench
Thickness gauge set (mm preferred)
50-gram force gauge
500-600-gram bar tension gauge
Soldering iron (30 watt)
DVOM
Dual-trace oscilloscope
High voltage probe
Clip lead
Small cleaning brushes
Small, battery-operated DC vacuum cleaner
Head cleaner or isopropol alcohol
Lint-free cleaning swabs
Small flashlight
Small dental-type mirror
Contact spray cleaner
Precision oiler
Specified lubricants
Specified adhesives
OEM schematics or Computerfacts™ as required
Pencil and paper
Troubleshooting log

ALPHABETICAL LIST OF REFERENCES USED IN DEVELOPING THIS TEXT

A. Groves, Bernard. *Basic Television Principle and Servicing.* New York, NY: McGraw Hill Book Company, 1975.

B. *SAMS Computerfacts™ CSCS2 COMPUTER: IBM® PC5150.* Indianapolis, IN 46206: Howard W. Sams & Co., Inc., 1985.

C. *SAMS Computerfacts™ CSCS4 COMPUTER: TRS-80® III.* Indianapolis, IN 46206: Howard W. Sams & Co., Inc., 1985.

D. *Service Manual SR-12 Manual.* Princeton, NJ 08540: Princeton Graphic Systems, 1984.

E. *Technical Training ZVM-131 & ZVM-135 Color Monitors.* Saint Joseph, MI 49085: Zenith Data Systems, 1981.

F. Tinnell, Richard W. *Television Symptom Diagnosis, An Entry into TV Servicing.* Indianapolis, IN 46268: Howard W. Sams & Co., Inc., 1977.

Important Information: Read Carefully!

Since schematics and other graphics vital to troubleshooting are not readily available from some manufacturers, SAMS Computerfacts™ published by Howard W. Sams are recommended materials for troubleshooting all popular brands of microcomputers, disk drives, printers, and monitors. They are especially recommended as complementary materials for the units in this text.

These Computerfacts™ are available from Howard W. Sams & Co., Inc., 4300 West 62nd Street, P.O. Box 7092, Indianapolis, Indiana, 46268. Orders for Computerfacts™ may also be placed toll free by calling 1-800-428-SAMS, or 1-800-298-5566.

On the following pages are listed the currently available Computerfacts™ for popular brands of disk drives, printers, and monitors. For convenience, available Computerfacts™ for microcomputers are also listed. The final page is a list of Computerfacts™ that should be available soon. Any questions about peripherals or microcomputers not listed should be directed to Howard W. Sams or called in to one of the toll free numbers listed above.

Single Computerfacts™ for peripherals should be ordered direct from Howard W. Sams. However, by special arrangements with Howard W. Sams, certain microcomputer Computerfacts™ are available in a special package at a special educational discount. Call MAVCC toll free at 1-800-654-3988 for complete information.

Monitors: Available Computerfacts™

Monitor(s)	Set Number	List Price*
Amdek Color 1 and Amdek Video 300	CMT-3	17.95
Hitachi CM1481 and Panasonic CT-1310M	CMT-1	17.95
IBM 5151 Color and IBM 5153 Monochrome	CMT-4	17.95
Panasonic CT-1320M and Zenith ZVM122A/123A	CMT-5	17.95
Panasonic CT-1350MG and Zenith ZVM-121	CMT-2	17.95
Panasonic CT-1920M and Sanyo AVM 196	CMT-6	17.95

*Prices are subject to change

Printers: Available Computerfacts™

Printer	Set Number	List Price*
Apple Imagewriter	CP-8	19.95
Commodore 1525	CP-4	17.95
Epson FX 80	CP-7	19.95
Epson MX 80 F/T	CP-1	17.95
Epson MX 100	CP-2	17.95
Epson RX 80	CP-9	19.95
IBM 5152-002	CP-3	17.95
NEC PC8025A	CP-5	17.95
TRS-80 DMP-120	CP-6	19.95

*Prices are subject to change

Disk Drives: Available Computerfacts™

Disk Drive(s)	Set Number	List Price*
Apple II A2M0003	CD-6	19.95
Commodore 1541 and VIC 1541	CD-4	17.95
Rana Elite I	CD-3	17.95
Rana Elite II	CD-2	17.95
Rana Elite III	CD-1	17.95
TRS-80 261164 A	CD-5	19.95
TRS-80 261160, 61	CD-7	19.95

*Prices are subject to change

Computers: Available Computerfacts™

Computer(s)	Set Number	List Price*
Apple II, II+	CC-1	17.95
Apple IIe	CC-10	19.95
Atari 400	CC-5	17.95
Atari 800	CC-7	17.95
Commodore 64	CC-4	17.95
Commodore C-16	CC-8	17.95
Commodore VIC 20	CC-3	17.95
Commodore Plus/4	CC-9	19.95
Epson QX-10 (Dual disk drives and monitor)	CSCS-4	39.95
Franklin Ace 100	CC-6	17.95
IBM PC 5150 (Dual disk drives)	CSCS-2	39.95
Osborne OCC1,OCC1A (Disk drive and monitor)	CSCS-1	39.95
TI-994/A	CC-2	17.95
TRS-80 I (Level II) (Disk drive and monitor)	CSCS-3	39.95
TRS-80 III (Disk drive and monitor)	CSCS-5	39.95

*Prices are subject to change

Other Computerfacts™ in the planning or development stages

Computers

Apple IIc
Atari 800 XL
IBM PC Jr
Macintosh
Zenith Z150
Zenith Z160

Printers

Commodore 4023
C Itoh 8510 AP
Epson FX100
Gimini 10X
Gimini 15X
NEC 3510
NEC 8023A
Okidata 80

(NOTE: This is only a partial listing, and all inquiries concerning Computerfacts™ development should be directed to the company address or called in to the toll free telephone numbers listed. Executives at Howard W. Sams have indicated that microcomputers or peripherals not on the SAMS development schedule will be placed there if significant need is evidenced from instructors or other professionals who may require them.)

INTRODUCTION TO PERIPHERAL REPAIR
UNIT I

UNIT OBJECTIVE

After completion of this unit, the student should be able to discuss the major differences between electronic and electromechanical troubleshooting and define the major problem areas in troubleshooting disk drives, printers, and monitors. These competencies will be evidenced by correctly performing the procedures outlined in the assignment sheet and by scoring 85 percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms related to introduction to peripheral repair with their correct definitions.
2. Complete statements concerning general categories of peripherals and their characteristics.
3. Complete statements concerning troubleshooting requirements for peripherals.
4. Select true statements concerning perspectives on electromechanical repair.
5. Solve problems concerning easy aspects of electromechanical troubleshooting.
6. Solve problems concerning dirt and electromechanical devices.
7. Solve problems concerning vibration and electromechanical devices.
8. Solve problems concerning improper use of electromechanical devices.
9. Solve problems concerning lubrication of electromechanical devices.
10. Solve problems concerning safety interlocks on electromechanical devices.

OBJECTIVE SHEET

11. Solve problems concerning special tools for electromechanical devices.
12. Select true statements concerning guidelines for troubleshooting floppy disk drives and printers.
13. Complete statements concerning guidelines for successful computer monitor repair.
14. Recommend solutions to peripheral repair problems.

INTRODUCTION TO PERIPHERAL REPAIR
UNIT I

SUGGESTED ACTIVITIES

A. Provide students with objective sheet.

B. Provide students with information and assignment sheets.

C. Discuss unit and specific objectives.

D. Discuss information sheet.

E. Invite a local or area technician who specializes in disk drive and/or printer repair to talk to the class about the problems and advantages of specializing.

F. Invite a local or area technician who specializes in monitor repair to talk to the class about problems encountered and special training required.

G. Have both printers and disk drives available to demonstrate how driver motors and stepper motors function as electromechanical devices in disk drives and printers.

H. Have available OEM schematics or technical materials to demonstrate to the class the type of graphic aids available for electromechanical troubleshooting.

I. Give test.

CONTENTS OF THIS UNIT

A. Objective sheet

B. Information sheet

C. Assignment sheet

D. Answers to assignment sheet

E. Test

F. Answers to test

REFERENCES USED IN DEVELOPING THIS UNIT

A. Groves, Bernard. *Basic Television Principles and Servicing.* New York, NY: McGraw Hill Book Company, 1975.

B. *SAMS Computerfacts™ CSCS2 COMPUTER: IBM® PC5150.* Indianapolis, IN 46206: Howard W. Sams & Co., Inc., 1985.

C. *SAMS Computerfacts™ CSCS4 COMPUTER: TRS-80® III.* Indianapolis, IN 46206: Howard W. Sams & Co., Inc., 1985.

D. *Service Manual SR-12 Manual.* Princeton, NJ 08540: Princeton Graphic Systems, 1984.

REFERENCES USED IN DEVELOPING THIS UNIT

E. *Technical Training ZVM-131 & ZVM-135 Color Monitors*. Saint Joseph, MI 49085: Zenith Data Systems, 1981.

F. Tinnell, Richard W. *Television Symptoms Diagnosis, An Entry into TV Servicing*. Indianapolis, IN 46268: Howard W. Sams & Co., Inc., 1977.

INTRODUCTION TO PERIPHERAL REPAIR
UNIT I

INFORMATION SHEET

I. **Terms and definitions**

   A. Electromechanical — The combination of a mechanical device such as a stepper motor with an electronic control

   B. FCC — Federal Communications Commission, a government agency that sets and enforces standards for communications equipment manufacturing and use

   C. Modem — A device that converts (modulates) digital signals into analog signals for transmission over telephone lines, and also converts (demodulates) analog signals into digital signals for use in microcomputer data exchange

   D. Particulate matter — Microscopic materials present in the air

   E. Platen — The rubber-covered main roller on a printer or typewriter

II. **General categories of peripherals and their characteristics**

   A. Disk drives are electromechanical devices

   B. Printers are electromechanical devices

   C. CRT-based monitors are electronic devices

   D. Graphics devices such as light pens and graphic pads are electronic devices

   E. Modems are electronic devices

III. **Troubleshooting requirements for peripherals**

   A. CRT-based monitors require electronic troubleshooting with traditional troubleshooting routines

   (NOTE: The fourth unit of this text is devoted to troubleshooting and repairing CRT-based monitors.)

   B. Graphics devices such as light pens and touch tablets are generally self-contained to such a degree that they are literally "throw-away" items or must be returned to the manufacturer

   (NOTE: These specialty devices require serial troubleshooting which entails relatively expensive equipment, so repair costs would frequently be more than replacement costs.)

INFORMATION SHEET

C. The RF sections of modems are so strictly controlled by FCC regulations that only certain licensed technicians are allowed to work on them

D. Modems can be checked for problems with cables or connectors and the IC's that control modulation and demodulation can be replaced, but other repairs to modems are not cost effective

E. Disk drives and printers require both electrical and mechanical troubleshooting, and a combination of the two called electromechanical troubleshooting

(NOTE: Except for the monitor repair unit, this text is dedicated to electromechanical repair of floppy disk drives and letter-quality and dot-matrix printers.)

IV. **Perspectives on electromechanical repair**

A. In a frequently used microcomputer system, there is more likelihood that a disk drive or printer will fail than there is tha the microcomputer itself will fail

B. The highest rate of failure in systems is with disk drives

C. The second highest rate of failure in systems is with printers

(NOTE: The high failure rate in system disk drives and printers is a combination of abrasive mechanical wear and vibration.)

D. Technicians skilled in electromechanical repair have the promise of plenty of work and a good job market

V. **Aspects of electromechanical troubleshooting**

A. Unlike electronic problems, electromechanical problems usually provide good clues that help localize the problem

Example: When a floppy disk will not rotate (clue), chances are the drive motor or its control circuit driver (localized) are at fault

B. Problem areas with electromechanical devices are similar:

1. Problems with dirt
2. Problems with vibration
3. Problems with improper use
4. Problems with lubrication
5. Problems with safety interlocks
6. Problems with improper repair

INFORMATION SHEET

C. Few electronics technicians have any experience with mechanical or electromechanical components

D. Technicians hoping to specialize in electromechanical repair need to broaden their knowledge in physics and mechanics

E. Although electromechanical problems can be quickly localized, the problem may as quickly become complex

F. Electrical failures sometimes contribute to mechanical failures and vice versa, and a good troubleshooter will have to sort out compound problems

VI. **Dirt and electromechanical devices**

A. Moving mechanical parts in disk drives and printers attract dust, dirt, and any particulate matter in the environment

B. In almost all troubleshooting routines with disk drives and printers, cleaning is the FIRST REQUIREMENT

C. Proper cleaning requires:

1. Small brushes
2. Alcohol-based cleaner
3. Lint-free swabs or wipes
4. Small battery/operated DC vacuum cleaner

VII. **Vibration and electromechanical devices**

A. Mechanical vibrations cause problems with cables and connectors

B. When checking for disk drive or printer failure, a rule of thumb is to check all connections first

C. Check all components that plug in because vibration can shake them loose, and IC's are especially subject to vibration displacement

D. Always replace adhesives or sealants removed from screws or nuts because these seals are designed to protect critical settings from vibration

INFORMATION SHEET

VIII. **Improper use of electromechanical devices**

A. A disk drive or printer used in an environment where people smoke is more subject to problems than the same equipment used in a smoke-free environment

B. Disk drives and floppy disks exposed to magnetic fields will not function properly

C. Head damage is common when a disk drive is moved without having a protective cardboard or disk inserted

D. The paper-out switch on certain printers breaks easily if the printer is moved without paper over the platen

IX. **Lubrication of electromechanical devices**

A. Certain mechanical parts in disk drives and printers require lubrication after repair or maintenance cleaning

B. Lubricating oils or compounds should be specifically those recommended by the manufacturer

C. Careless lubrication can saturate components that require no lubrication and contribute to component failure

D. Excess lubrication adds to the tendency of moving mechanical parts to attract dust and dirt

E. Plastic oiling bottles with nondrip spouts are recommended for most applications

F. Precision oilers with needle-like spouts are recommended for certain disk drive applications where excess oil could easily damage a read/write head and the disk media

X. **Safety interlocks on electromechanical devices**

A. Certain electromechanical devices are safety interlocked between mechanical covers and a power supply

B. These safety interlocks are designed to protect an end user from inadvertent exposure to electric shock

C. Troubleshooters must learn to spot safety interlocks and how to bypass them in order to service or repair equipment

INFORMATION SHEET

XI. **Special tools for electromechanical devices**

A. Do not attempt to use a conventional tool on a disk drive or printer in place of a special tool specified for adjustment or disassembly

B. Using an improper tool on a peripheral can easily do more damage than good, especially improper use of an alignment or adjustment tool

XII. **Guidelines for troubleshooting disk drives and printers**

A. Even a good electronics technician will at first have difficulty recognizing a mechanical problem, so OEM technical materials must be available and must be properly referenced

B. The best way to become good at troubleshooting disk drives and printers is to follow procedures carefully, and NEVER ATTEMPT SHORTCUTS

Example: Short cuts in electronic troubleshooting are common because certain components provide easily recognized clues that tell you whether or not they need testing

C. Employ traditional troubleshooting routines such as half-splitting, forward-to-back, and back-to-forward whenever they appear to be appropriate

D. Approach all peripheral troubleshooting systematically so that those elements essential to overall operation are verified before other troubleshooting begins

XIII. **Guidelines for successful computer monitor repair**

A. Look for obvious problems such as loose cables or connectors or contrast or brightness controls that have been improperly set

B. Have OEM technical materials or a Computerfacts™ available for reference

C. Use the CRT picture itself as a troubleshooting tool to help isolate the problem

D. Study CRT operations so you will be able to separate digital and analog functions for troubleshooting

INFORMATION SHEET

E. Concentrate on learning to work with an RGB monitor because the monochrome signal is a subset of the color signal and learning RGB troubleshooting will serve a dual purpose

F. Work with caution around the high voltage and horizontal sweep sections of a monitor because voltages range from 20,000V upward

G. Respect the CRT itself as a potentially dangerous component, and never drop a CRT

INTRODUCTION TO PERIPHERAL REPAIR
UNIT I

ASSIGNMENT SHEET #1 — RECOMMEND SOLUTIONS TO PERIPHERAL REPAIR PROBLEMS

A. What repair options would you recommend for a touch tablet?

Answer ____

____

B. What recommendations would you make to a technician planning to work on a modem?

Answer ____

____

C. Why would it be safe to recommend that a technician specialize in either disk drive or printer repair or both?

Answer ____

____

D. What courses would you recommend to a fellow student who wants to become better at disk drive and printer repair?

Answer ____

____

E. What is the first thing you'd recommend to a technician troubleshooting a disk drive?

Answer ____

____

F. What recommendation would you make concerning the use of adhesives on a printer?

Answer ____

____

G. What would you recommend to prevent head damage when moving a disk drive?

Answer ____

____

INTRODUCTION TO PERIPHERAL REPAIR
UNIT I

ANSWERS TO ASSIGNMENT SHEET

(NOTE: For a student answer to be correct, it must approximate the answer given here.)

A. Discard and replace it or ship it back to the manufacturer for repair

B. Check the cables and connections, but otherwise, leave it alone

C. In a frequently used microcomputer system, disk drives have the highest failure rate and printers have the second highest failure rate

D. Physics and mechanics courses

E. Clean it!

F. Use them as directed and be sure to replace adhesives removed to facilitate troubleshooting

G. Insert a cardboard protector or an old floppy disk

INTRODUCTION TO PERIPHERAL REPAIR
UNIT I

NAME ______________________

TEST

1. Match the terms on the right with their correct definitions.

    _____a. Microscopic materials present in the air

    _____b. The rubber-covered main roller on a printer or typewriter

    _____c. The combination of a mechanical device such as a stepper motor with an electronic control

    _____d. A government agency that sets and enforces standards for communications equipment manufacturing and use

    _____e. A device that converts digital signals into analog signals for transmission over telephone lines, and also converts analog signals into digital signals for use in microcomputer data exchange

    1. Electromechanical
    2. FAA
    3. FCC
    4. Modem
    5. Particulate matter
    6. Platen

2. Complete the following statements concerning general categories of peripherals and their characteristics by circling the word(s) that best completes each statement.

    a. Disk drives are (**electronic, electromechanical**) devices

    b. Printers are (**electronic, electromechanical**) devices

    c. CRT-based monitors are (**electronic, electromechanical**) devices

    d. Graphics devices such as light pens and graphic pads are (**electronic, electromechanical**) devices

    e. Modems are (**electronic, electromechanical**) devices

3. Complete statements concerning troubleshooting requirements for peripherals by inserting the word(s) that best completes each statement.

    a. CRT-based monitors require electronic troubleshooting with ____________ troubleshooting routines

    b. Graphics devices such as light pens and touch tablets are generally self-contained to such a degree that they are literally ____________-____________ items or must be returned to the manufacturer

TEST

c. The ____________ ____________ of modems are so strictly controlled by FCC regulations that only certain licensed technicians are allowed to work on them

d. Modems can be checked for problems with cables or connectors and the IC's that control modulation and demodulation can be replaced, but other repairs to modems are not ____________ ____________

e. Disk drives and printers require both electrical and mechanical troubleshooting, and a combination of the two called ____________ troubleshooting

4. Select true statements concerning perspectives on electromechanical repair by placing an "X" in the appropriate blanks.

_____a. In a frequently used microcomputer system, there is more likelihood that a disk drive or printer will fail than there is that the microcomputer itself will fail

_____b. The highest rate of failure in systems is with printers

_____c. The second highest rate of failure in systems is with disk drives

_____d. Technicians skilled in electromechanical repair have the promise of plenty of work and a good job market

5. Complete the following statements concerning aspects of electromechanical troubleshooting by circling the word(s) that best completes each statement.

a. Unlike electronic problems, electromechanical problems (**seldom, usually**) provide good clues that help localize the problem

b. Problem areas with electromechanical devices are (**similar, vary greatly with the equipment type**)

c. Few electronics technicians have any experience with (**electronic, mechanical**) or electromechanical components

d. Technicians hoping to specialize in electromechanical repair need to broaden their knowledge in (**physics, chemistry**) and mechanics

e. Although electromechanical problems can be quickly localized, the problem may as quickly become (**simple, complex**)

f. Electrical failures sometimes contribute to mechanical failures and vice versa, and a good troubleshooter will have to sort out (**simple, compound**) problems

6. Solve problems concerning dirt and electromechanical devices.

What supplies are required for the proper cleaning of moving mechanical parts in disk drives and printers? (name at least three)) ______________________________

____

TEST

7. Solve problems concerning vibration and electromechanical devices.

   a. When checking for disk drive or printer failure, a rule of thumb is to check ____________ first.

   b. Always replace adhesives or sealants removed from screws or nuts because these seals are designed to protect critical settings from ____________.

8. Solve problems concerning improper use of electromechanical devices.

   a. What is one way to protect a disk drive from head damage when it is moved?

   ____

   b. If certain printers are moved without paper over their platens, what can happen?

   ____

   c. Name one environment where disk drives and printers are more subject to problems. ____

   ____

9. Solve problems concerning lubrication of electromechanical devices.

   a. What basic devices are recommended for most applications of lubricating oils or compounds?

   ____

   b. What special devices are recommended for certain disk drive applications where excess oil could easily damage a read/write head and the disk media?

   ____

10. Solve problems concerning safety interlocks on electromechanical devices.

    a. Certain electromechanical devices are safety interlocked between mechanical covers and a ____________.

    b. These safety interlocks are designed to protect an end user from ____________

    ____.

11. Solve problems concerning special tools for electromechanical devices.

    If a special tool is specified for adjustment or disassembly of a disk drive or printer, may a convenient tool be substituted? ____________________________

    If yes, why? If no, why not? ____________________________

    ____

TEST

12. Select true statements concerning guidelines for troubleshooting disk drives and printers by placing an "X" in the appropriate blanks.

    _____a. Even a good electronics technician will at first have difficulty recognizing a mechanical problem, so OEM technical materials must be available and must be properly referenced

    _____b. The best way to become good at troubleshooting disk drives and printers is to attempt shortcuts as often as possible

    _____c. Do **not** use routines such as half-splitting, forward-to-back, and back-to-forward

    _____d. Approach all peripheral troubleshooting systematically so that those elements essential to overall operation are verified before other troubleshooting begins

13. Complete statements concerning guidelines for successful computer monitor repair by inserting the word(s) that best completes each statement.

    a. Look for ____________ problems such as loose cables or connectors or contrast or brightness controls that have been improperly set

    b. Have OEM ____________ materials or a Computerfacts™ available for reference

    c. Use the CRT picture itself as a ____________ tool to help isolate the problem

    d. Study CRT operations so you will be able to separate ____________ and ____________ functions for troubleshooting

    e. Concentrate on learning to work with an ____________ monitor because the monochrome signal is a subset of the color signal and learning ____________ troubleshooting will serve a dual purpose

    f. Work with caution around the ____________ ____________ and horizontal sweep sections of a monitor because voltages range from 20,000V upward

    g. Respect the ____________ itself as a potentially dangerous component, and never drop a ____________

(NOTE: If the following activity has not been accomplished prior to the test, ask your instructor when it should be completed.)

14. Recommend solutions to peripheral repair problems.

INTRODUCTION TO PERIPHERAL REPAIR
UNIT I

ANSWERS TO TEST

1. a. 5
   b. 6
   c. 1
   d. 3
   e. 4

2. a. Electromechanical
   b. Electromechanical
   c. Electronic
   d. Electronic
   e. Electronic

3. a. Traditional
   b. Throw-away
   c. RF sections
   d. Cost effective
   e. Electromechanical

4. a,d

5. a. Usually
   b. Similar
   c. Mechanical
   d. Physics
   e. Complex
   f. Compound

6. Any three of the following:
   a. Small brushes
   b. Alcohol-based cleaner
   c. Lint-free swabs or wipes
   d. Small battery-operated DC vacuum cleaner

7. a. Connections
   b. Vibration

8. a. Insert a protective cardboard or disk prior to moving
   b. The paper-out switch can break
   c. An environment where people smoke

9. a. Plastic oiling bottles with nondrip spouts
   b. Precision oilers with needle-like spouts

10. a. Power supply
    b. Inadvertent exposure to electric shock

ANSWERS TO TEST

11. No, because it can easily do more damage than good

12. a,d

13. a. Obvious
    b. Technical
    c. Troubleshooting
    d. Digital, analog
    e. RGB, RGB
    f. High voltage
    g. CRT, CRT

14. Evaluated to the satisfaction of the instructor

SERVICING AND REPAIRING DOT-MATRIX PRINTERS
UNIT II

UNIT OBJECTIVE

After completion of this unit, the student should be able to list the components of a dot-matrix printer, discuss the interaction of printer components, and relate mechanical and electronic controls to their functions. The student should also be able to clean, adjust, and lubricate a dot-matrix printer, change a ribbon, and troubleshoot and repair major printer malfunctions. These competencies will be evidenced by correctly performing the procedures outlined in the job sheets and by scoring 85 percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms related to servicing and repairing dot-matrix printers with their correct definitions.
2. Select true statements concerning design features of the Microline 92 (ML92) dot-matrix printer.
3. Match ML92 electronic controls with their functions.
4. Match ML92 mechanical controls with their functions.
5. Match ML92 selection and protection controls with their functions.
6. Select true statements concerning printhead operation on the ML92.
7. Complete statements concerning other ML92 printhead characteristics.
8. Select true statements concerning spacing and carriage operations on the ML92.
9. Complete statements concerning ribbon feed operations on the ML92.

OBJECTIVE SHEET

10. Complete statements concerning paper feed operations on the ML92.
11. Select true statements concerning paper-out detection devices on the ML92.
12. Select true statements concerning printhead gap adjustment on the ML92.
13. Complete a list of control board features of the ML92.
14. Select true statements concerning motor specifications on the ML92.
15. Complete a list of protective devices on the ML92.
16. Arrange in order the steps in initializing the ML92.
17. Select true statements concerning the operating cycle in an ML92.
18. Complete statements concerning some ML92 problems and suggested solutions.
19. Complete statements concerning ML92 interfaces.
20. Demonstrate the ability to:
    a. Install paper feeding devices on an ML92 printer. (Job Sheet #1)
    b. Remove the upper case on an ML92 printer and replace the system fuse. (Job Sheet #2)
    c. Replace a ribbon and install cut-sheet, roll, and sprocket-fed paper on an ML92 printer. (Job Sheet #3)
    d. Operate an ML92 printer to check control functions and run a printer self test. (Job Sheet #4)
    e. Make tension and gap adjustments on an ML92 printer. (Job Sheet #5)
    f. Remove and replace major components of an ML92 printer. (Job Sheet #6)
    g. Troubleshoot an ML92 printer when the printhead does not move at power-up. (Job Sheet #7)
    h. Troubleshoot an ML92 printer when the carriage keeps running right or left at power-up. (Job Sheet #8)
    i. Troubleshoot an ML92 printer when the carriage vibrates at power-up. (Job Sheet #9)
    j. Troubleshoot an ML92 printer when the circuit breaker opens at power-up. (Job Sheet #10)

OBJECTIVE SHEET

k. Troubleshoot an ML92 printer when printing or spacing operations do not start with data input. (Job Sheet #11)

l. Troubleshoot an ML92 printer when the printer spaces but will not print. (Job Sheet #12)

m. Troubleshoot an ML92 printer when the printer prints but will not space (Job Sheet #13)

n. Troubleshoot an ML92 printer when the printhead will not return to home after printing. (Job Sheet #14)

o. Troubleshoot an ML92 printer when it will not perform line feed functions. (Job Sheet #15)

p. Troubleshoot an ML92 printer when the paper-out detector is not working. (Job Sheet #16)

q. Troubleshoot an ML92 printer when some characters are not printed and other characters are printed wrong. (Job Sheet #17)

r. Troubleshoot an ML92 printer when some dots in the matrix are not printed. (Job Sheet #18)

s. Troubleshoot an ML92 printer for an open circuit breaker. (Job Sheet #19)

t. Troubleshoot an ML92 printer when the system fuse blows. (Job Sheet #20)

u. Troubleshoot an ML92 printer when the switches on the operation panel will not work. (Job Sheet #21)

v. Troubleshoot an ML92 printer when the print is not dark enough. (Job Sheet #22)

SERVICING AND REPAIRING DOT-MATRIX PRINTERS
UNIT II

SUGGESTED ACTIVITIES

A. Provide student with objective sheet.

B. Provide student with information and job sheets.

C. Make transparencies.

D. Discuss unit and specific objectives.

E. Discuss information sheet.

F. Discuss and demonstrate the procedures outlined in the job sheets.

G. Obtain from a local vendor or computer store a copy of OKIDATA's *Microline 92 DOT-MATRIX PRINTER (Standard Model) Maintenance Manual* to use as a reference for any student questions about procedures in the job sheets.

H. Should a microline 92 dot-matrix printer not be available at your school, arrange for a service center or computer store in the area to lend you one, or find someone at your school who has a Microline 92 that needs repair, and use it to demonstrate the materials in the job sheets.

I. Have available a standby printer to use for known good parts, especially the boards that may require replacing.

J. With materials from the *Maintenance Manual*, show students the layout of the PC boards used by the ML92, and demonstrate to the students procedures for troubleshooting the boards.

K. Have available other brands of dot-matrix printers and point out to the class both the similarities and differences between them and the ML92.

L. Give test.

CONTENTS OF THIS UNIT

A. Objective sheet

B. Information sheet

C. Transparency masters

    1. TM 1 — ML92 Components

    2. TM 2 — ML92 Controls and Indicators

CONTENTS OF THIS UNIT

   3. TM 3 — ML92 Switch Functions
   4. TM 4 — ML92 Mechanical Controls
   5. TM 5 — ML92 Selection and Protection Controls
   6. TM 6 — ML92 Control Board Features
   7. TM 7 — ML92 Block Diagram
   8. TM 8 — ML92 Parallel Interface Signals

D. Job sheets

   1. Job Sheet #1 — Install Paper Feeding Devices on an ML92 Printer
   2. Job Sheet #2 — Remove the Upper Case on an ML92 Printer and Replace the System Fuse
   3. Job Sheet #3 — Replace a Ribbon and Install Cut-Sheet, Roll, and Sprocket-Fed Paper on an ML92 Printer
   4. Job Sheet #4 — Operate an ML92 Printer to Check Control Functions and Run a Printer Self Test
   5. Job Sheet #5 — Make Tension and Gap Adjustments on an ML92 Printer
   6. Job Sheet #6 — Remove and Replace Major Components of an ML92 Printer
   7. Job Sheet #7 — Troubleshoot an ML92 Printer When the Printhead Does Not Move at Power-Up
   8. Job Sheet #8 — Troubleshoot an ML92 Printer When the Carriage Keeps Running Right or Left at Power-Up
   9. Job Sheet #9 — Troubleshoot an ML92 Printer When the Carriage Vibrates at Power-Up
   10. Job Sheet #10 — Troubleshoot an ML92 Printer When the Circuit Breaker Opens at Power-Up
   11. Job Sheet #11 — Troubleshoot an ML92 Printer When Printing or Spacing Operations Do Not Start With Data Input
   12. Job Sheet #12 — Troubleshoot an ML92 Printer When the Printer Spaces But Will Not Print
   13. Job Sheet #13 — Troubleshoot an ML92 Printer When the Printer Prints But Will Not Space

CONTENTS OF THIS UNIT

14. Job Sheet #14 — Troubleshoot an ML92 Printer When The Printhead Will Not Return to Home After Printing

15. Job Sheet #15 — Troubleshoot an ML92 Printer When it Will Not Perform Line Feed Functions

16. Job Sheet #16 — Troubleshoot an ML92 Printer When the Paper-Out Detector is Not Working

17. Job Sheet #17 — Troubleshoot an ML92 Printer When Some Characters are not Printed and Other Characters are Printed Wrong

18. Job Sheet #18 — Troubleshoot an ML92 Printer When Some Dots in the Matrix are not Printed

19. Job Sheet #19 — Troubleshoot an ML92 Printer for an Open Circuit Breaker

20. Job Sheet #20 — Troubleshoot an ML92 Printer When the System Fuse Blows

21. Job Sheet #21 — Troubleshoot an ML92 Printer When the Switches on the Operation Panel Will Not Work

22. Job Sheet #22 — Troubleshoot an ML92 Printer When the Print is not Dark Enough

E. Test

F. Answers to test

REFERENCES USED IN DEVELOPING THIS UNIT

A. *Microline 92 Dot-Matrix Printer (Standard Model) Maintenance Manual.* Mt. Laurel, NJ 08054: Okidata, 1984.

B. *OKIDATA Pacemark 2410 Printer Maintenance Manual.* Mt. Laurel, NJ 08054: Okidata, 1984.

SERVICING AND REPAIRING DOT-MATRIX PRINTERS
UNIT II

INFORMATION SHEET

I. **Terms and definitions**

   A. CN — A schematic or block diagram notation for a connector

   B. CPI (characters per inch) — The measurement of the density of characters in a horizontal line of print

   C. Pitch — Another method of measuring the density of characters in a horizontal line of print

   D. Pica type — Printing at a pitch of 10 CPI which gives clear, easy-to-read letters and is a popular pitch for business letters and reports

   E. Elite type — Printing at a pitch of 12 CPI which puts more words on a page and is popular for business uses and for conserving space in long reports

   F. Condensed type — Printing at a pitch of 15 CPI which is a popular pitch for tables and charts where much information has to go into limited space

   G. Proportional pitch — A pitch that balances out white space between wide letters such as "M" and narrow letters such as "I" to make a printed page look better

   H. CPS (characters per second) — A measurement of how fast a printer prints

   I. LPI (lines per inch) — The measurement of the number of lines in a vertical inch of space

   J. Single space — Printing at 8 LPI

   K. Space and a half — Printing at 6 LPI

   L. Double space — Printing at 4 LPI

   M. Triple space — Printing at 2 LPI

INFORMATION SHEET

II. **Design features of the Microline 92 dot-matrix printer** (Transparency 1)

A. The ML92 is a desk-top, serial-type, dot-matrix printer designed for use with personal computers

(NOTE: Because of its design features, the Microline 92, manufactured by OKIDATA, has been selected to help detail typical service and repair procedures for dot-matrix printers, and the materials in this objective and the following objectives in the Information Sheet are adapted from materials copyrighted ©1985 by OKIDATA, a division of OKI AMERICA, Inc. Limited permission to copy has been granted by OKIDATA to MAVCC. Any unauthorized use or reproduction of these copyrighted materials will be prosecuted to the full extent allowed by law.)

B. The ML92 components include a print mechanism, a control unit, an operation panel, and a power supply housed in a case with an access cover that is easy to remove

C. The ML92's 5 × 9 matrix permits printing with true descenders, expanded printing that provides double-width characters, underlining, graphics capabilities, and letter quality printing

D. The ML92 is rated as a high-speed printer capable of printing 160 cps

III. **ML92 electronic control and their functions** (Transparency 2)

A. AC power switch — Switches AC power On and OFF

B. Power LED — Lights up red when power is switched ON

C. Paper LED — Lights up red when it detects printer is out of paper

D. SEL switch — Changes the online/offline status of the printer

E. SEL LED — Lights up red when printer is in online status and goes out when printer is in offline status

F. FORM FEED switch — Works when printer is in offline status, and feeds paper to the next top-of-form position when depressed

G. LINE FEED switch — Works when printer is in offline status, feeds paper one line at a time when depressed, and is used for the printer self test function

H. FORM LENGTH rotary switch — Selects paper lengths (Transparency 3)

I. DIP switch — Selects printer functions (Transparency 3)

INFORMATION SHEET

IV. **ML92 mechanical controls and their functions** (Transparency 4)

A. Paper-clamp lever — Controls paper feed pressure and is closed for cut-sheet or roll paper and open for sprocket paper

B. Head-gap adjusting lever — Adjusts printing pressure according to paper type and thickness

(NOTE: See Job Sheet #3, Procedures E and F.)

C. Platen knob — Manual control for feeding paper up or down

D. Guide bar — Manual control for guiding paper, and it is set upright or open for cut-sheet and roll paper and closed for sprocket paper

(NOTE: See Job Sheet #3, Procedures C and D.)

V. **ML92 selection and protection controls and their functions** (Transparency 5)

A. Circuit breaker — Protects the printer from AC input overcurrent

(**CAUTION:** When the breaker is tripped to open, all printer operations stop, but before resetting the breaker TURN OFF THE AC POWER SWITCH.)

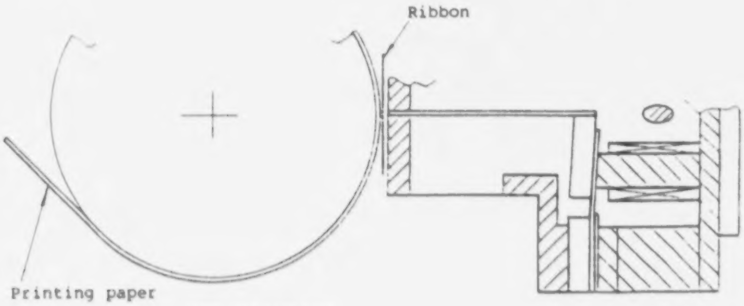
B. Voltage-select switch — A switch designed for a special model that permits selection of either 220V or 240V power supply

C. Jumper plug — Selects the 7 or 8-bit data bit length

VI. **Printhead operation on the ML92**

A. When the printhead is not printing, the individual print wires are held in the wire guide by the attraction of a permanent magnet (Figure 1)

FIGURE 1



NOT PRINTING

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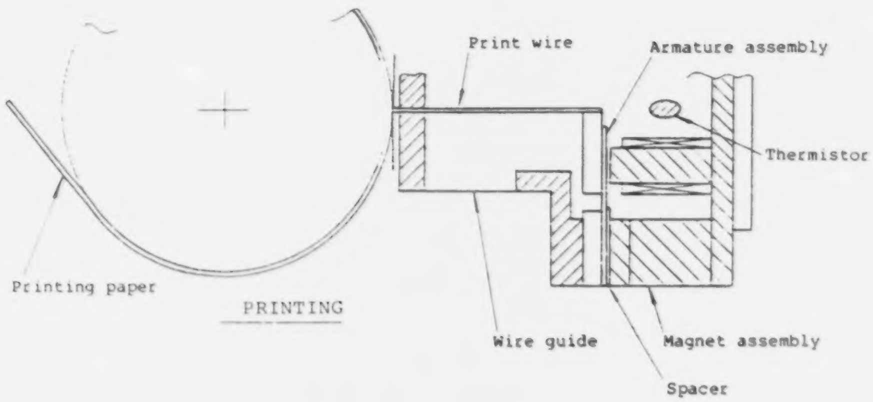
INFORMATION SHEET

B. When a print signal is received by an individual print wire, the magnetic field is nullified and the print wire is propelled toward the platen by a spring

C. The force of the spring drives the print wire through the tip of the wire guide where it strikes the paper through the ribbon and prints a dot (Figure 2)

FIGURE 2



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VII. **Other ML92 printhead characteristics**

A. The printhead has a built-in thermistor to prevent overheating from continuous bidirectional printing (Figure 2)

B. Anytime the coil temperature exceeds 194°F (90°C), the thermistor signals the control circuit to switch from bidirectional to unidirectional print, and the control circuitry stops the printer until the coil cools below the limit

(**CAUTION:** Be careful about touching a printhead that has been operating for even a short period because they quickly become hot enough to burn your fingers.)

VIII. **Spacing and carriage operations on the ML92** (Figure 3)

A. The carriage with the printhead mounted on it is driven by a stepper motor which moves the carriage along upper and lower carriage shafts

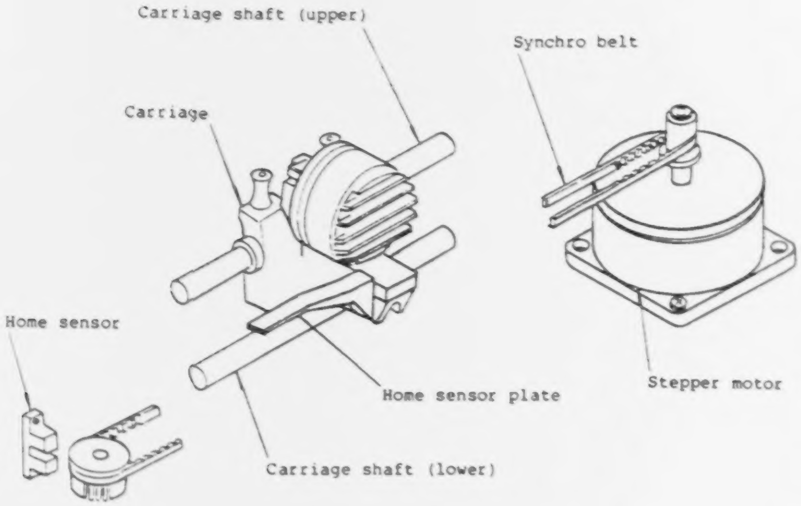
B. As the stepper motor rotates clockwise, the carriage moves from left to right

C. As the stepper motor rotates counterclockwise, the carriage moves from right to left to return the carriage to its home position

INFORMATION SHEET

D. The carriage movement causes the home sensor plate to pass through the home sensor slit where it intercepts light from a pair of light-emitting and photo diodes, and this generates a pulse which stops the stepper motor and leaves the carriage in its start position

FIGURE 3


Carriage shaft (upper)
Synchro belt
Carriage
Home sensor
Home sensor plate
Stepper motor
Carriage shaft (lower)

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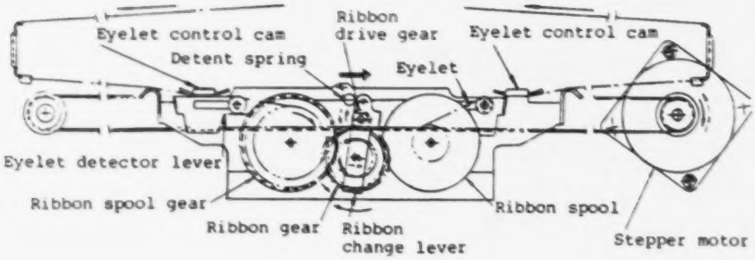
IX. Ribbon feed operations on the ML92

A. The ribbon feed operations are basically accomplished by the same stepper motor force that drives the carriage

INFORMATION SHEET

B. As the stepper motor rotates clockwise and moves the carriage from left to right, the ribbon drive gear engages the left ribbon spool causing it to turn clockwise, and this feeds the ribbon to the left (Figure 4)

FIGURE 4


Ribbon drive gear
Eyelet control cam
Detent spring
Eyelet
Eyelet control cam
Eyelet detector lever
Ribbon spool gear
Ribbon gear
Ribbon change lever
Ribbon spool
Stepper motor

Ribbon feed to left

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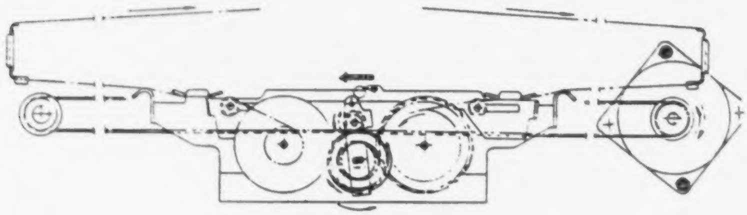
C. As the stepper motor rotates counterclockwise and moves the carriage from right to left, the ribbon drive gear engages the right ribbon spool causing it to turn counterclockwise and feed the ribbon to the right (Figure 5)

FIGURE 5



Ribbon feed to right

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D. The eyelet control cams right and left and the eyelet detector lever work in conjunction with the detent spring to permit the ribbon to idle at the appropriate time or to switch ribbon feed from one direction to the other at the appropriate time

INFORMATION SHEET

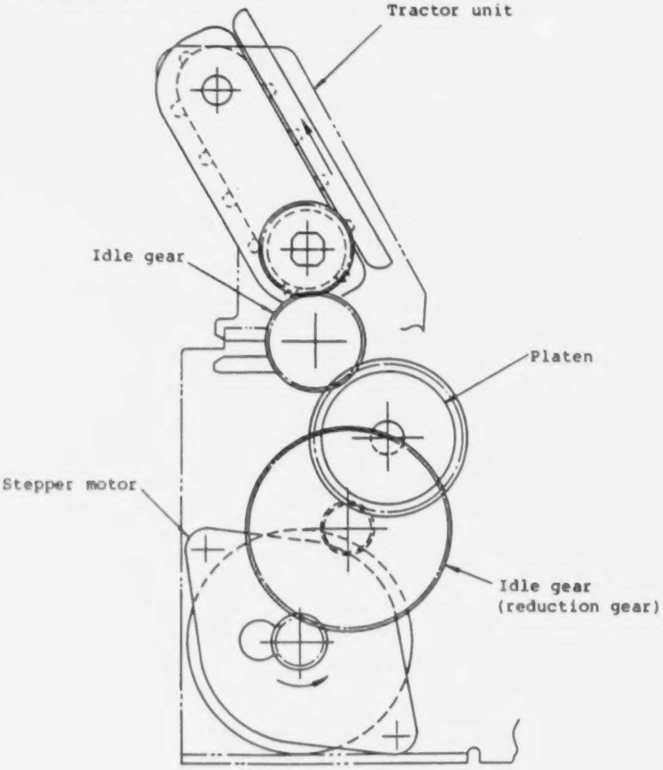
X. **Paper feed operations on the ML92** (Figure 6)

A. The paper feed operations originate with the stepper motor mounted on the left side of the frame

B. As the stepper motor rotates, it transmits power through a reduction gear to operate the fixed-pin platen, and the power is transmitted through an idler gear to the tractor unit

C. The paper-clamp lever permits paper to be inserted when it is open and helps feed paper when it is closed

FIGURE 6


Tractor unit
Idle gear
Platen
Stepper motor
Idle gear
(reduction gear)

Paper Feed Mechanism

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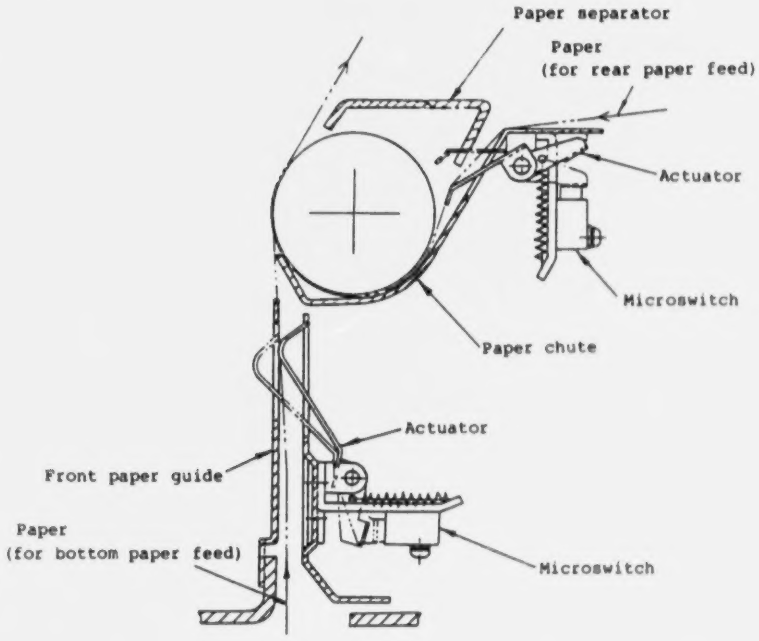
INFORMATION SHEET

XI. **Paper-out detection devices on the ML92** (Figure 7)

A. When paper is fed from the rear of the printer, the paper pressure prevents the microswitch actuator from falling into the groove of the paper separator, but when remaining paper length is about 2", the actuator turns the microswitch ON to indicate the printer is almost out of paper

B. The paper-out detection for paper fed from the bottom is also an actuator-microswitch arrangement, but in the case of paper feeding from the bottom, the microswitch is activated when there is about 1" of paper remaining

FIGURE 7


Paper separator
Paper
(for rear paper feed)
Actuator
Microswitch
Paper chute
Actuator
Front paper guide
Paper
(for bottom paper feed)
Microswitch

Paper-Out Detection Mechanism

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XII. **Printhead gap adjustment on the ML92** (Figure 8)

A. The gap between the platen and the printhead is controlled by moving the head-gap adjusting lever which is fitted by eccentric collars to the upper carriage shaft

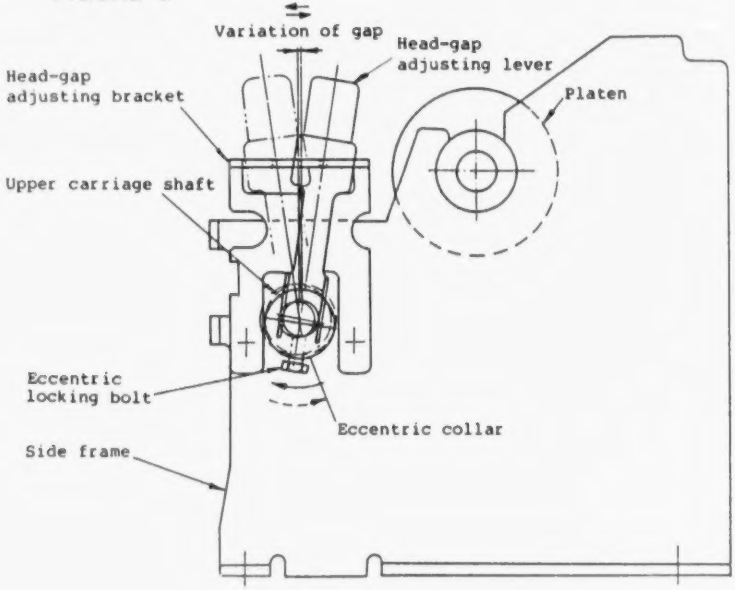
B. When the eccentric collars are moved clockwise, the upper carriage shaft moves the printhead closer to the platen, and when the collars move counterclockwise, the printhead moves farther away from the platen

INFORMATION SHEET

C. Since an eccentric locking bolt secures the eccentric collars, the bolt can be loosened to obtain any desired printhead gap adjustment and then the bolt is retightened

D. Shifting the head-gap adjusting lever manually will change the gap between the printhead and the platen by 0.15mm

FIGURE 8


Variation of gap
Head-gap adjusting lever
Head-gap adjusting bracket
Platen
Upper carriage shaft
Eccentric locking bolt
Eccentric collar
Side frame

Head-Gap Adjusting Mechanism

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XIII. **Control board features of the ML92** (Transparency 6)

A. The control section is essentially a single board microprocessor with two microprocessors and a DC power supply

B. The 8051 is an 8-bit microprocessor run by a 12 MHz clock, and contains a 128-byte RAM and two 8-bit timers

C. The 8741 is an 8-bit microprocessor run by a 6 MHz clock, and contains a 1-K ROM, a 64-byte RAM, and an 8-bit timer

D. Other major board components include two 8-kilobyte ROMs, one 2-kilobyte RAM, and one 256-byte RAM with I/O ports

E. The 8051 microprocessor generates timing signals, addresses ROM and RAM through the data bus, and uses some of its I/O ports to control and select from the nine heads in the printhead

INFORMATION SHEET

F. The 8741 microprocessor generates timing signals for the motors and uses its Port 1 to control the space motor and the line feed motor

G. The 256-byte RAM contains a timer and I/O ports and is used to control the parallel interface

XIV. Motor specifications on the ML92

A. The carriage is driven by a space motor which is a four-phase stepper motor with a step angle of 1.8°

B. When the space motor advances 12 steps, the carriage moves 2.54mm or 0.1 inch (character pitch in 10-CPI mode)

C. Line feed operation is powered by a line-feed motor which is a four-phase stepper motor with a step angle of 7.5°

D. When the line-feed motor advances 24 steps, the paper is fed 4.23mm or 0.17 inch (a line pitch in 6-LPI mode)

E. When the line-feed motor advances 18 steps, the paper is fed 3.18mm or 0.13 inch (a line pitch in 8-LPI mode)

XV. Protective devices on the ML92

A. The power supply is so designed that a constant current flows to both the printhead and space motor even if the 35V line voltage changes because of input or load variations

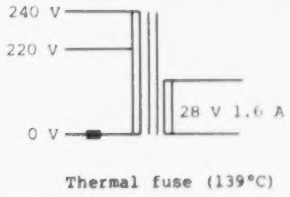
B. The printer also has a protective circuit to detect trouble in the peripheral circuits or drivers of the printhead, space motor, and line-feed motor

(NOTE: Voltage applied to the motor is checked by a comparator, and if a voltage greater than 3.7V is applied continuously for about 3 seconds, an SCR thyristor turns on and opens a breaker.)

C. The power transformer has a built-in thermal fuse which prevents the transformer from being burned due to an abnormally high temperature rise (Figure 9)

FIGURE 9

Circuit diagram example (in the case of 4LP-45191-135-A)



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INFORMATION SHEET

D. Anytime the printhead temperature exceeds about 210°F during continuous printing, the printer goes from a unidirectional to a bidirectional printing mode until the head cools down

E. When the printhead cools down, bidirectional printing resumes, but if the temperature doesn't cool after 66 blocks of unidirectional printing, the entire printing operation is shut down until the head cools

XVI. **Initializing the ML92**

A. Initializing the printer means clearing the circuitry, setting the carriage at the home position, and placing the printer in a ready-for-input mode

B. Initialization starts when the AC power is turned on causing a RESET signal to be sent to the 8051 microprocessor to clear it

C. After the clearing, the program runs and the carriage returns to the home position

(NOTE: If the carriage is in the home position when initialization starts, the carriage should move a little to the right and then return to the home position.)

D. During the initialization routine, the BUSY signal of the interface is held at 1 so the printer cannot accept print data

E. When initializing is complete, the BUSY signal goes to 0 and the printer is in the ready-for-input mode

XVII. **Operating cycle in an ML92** (Transparency 7)

A. When the AC power switch is turned ON, a RESET signal is sent to the main microprocessor to clear the printer circuitry and put the printer in a ready-for-input state with the BUSY signal at zero

B. Data bits are input to the I/O port as 8-bit parallel data while the BUSY signal is at 0 along with a $\overline{\text{STROBE}}$ signal sent by the host computer

C. The parallel data is latched internally at the rising edge of the $\overline{\text{STROBE}}$ signal, and after the data is latched the BUSY signal goes back to 1 and the main microprocessor starts processing the input data

D. The microprocessor determines whether the data is print data or control data so that print data is written into RAM and control data causes whatever is written in RAM to be printed

E. When input data amounts to the quantity of one print line, the data is printed, and as the processing is completed, the BUSY signal is set to 0 again and a pulse is sent to the $\overline{\text{ACKNOWLEDGE}}$ terminal

INFORMATION SHEET

F. As the BUSY signal returns to 0, the printer is back in a ready-for-input state and the input-print cycle can be repeated

(NOTE: If the receiving buffer is not full, it can accept print data for the next line even while the printer is printing, and this provides the ML92 with its high-speed print capabilities.)

XVIII. **Some ML92 problems and suggested solutions**

A. Power LED does not light

1. Probably caused by an improperly connected AC power supply cable or an open circuit breaker

2. Solve the problem by properly connecting the AC power plug, or turn the AC power switch OFF and reset the circuit breaker by pressing it down

   (NOTE: If the circuit breaker trips repeatedly, it indicates other problems.)

B. The PAPER LED lights

1. Probably caused by paper running out or too little paper left

2. Solve the problem by installing new paper

C. Paper won't feed

1. Probably caused by the paper-clamp lever being open when cut-sheet or roll paper is being used or by holes in paper not properly set on the sprocket pins when sprocket paper is being used

2. Solve the problem by installing the paper properly or closing the head-gap lever

D. Paper tears

1. Probably caused because wrong paper is being used, head-gap adjusting lever is not set properly, or paper is not installed properly

2. Solve the problem by using the correct paper, changing the head-gap adjusting lever to the correct position, or installing paper properly

E. Ribbon does not print

1. Probably caused by a ribbon that's worn out or not threaded properly, but could be in the ribbon feed mechanism

INFORMATION SHEET

2. Solve the problem by changing the ribbon or checking the ribbon feed mechanism

   (NOTE: These items are covered in the job sheets that accompany this unit of instruction.)

F. Printer does not operate

1. Probably caused by a blown fuse or one of several other problems

2. Solve the problem by first turning the AC power switch OFF and then turning it ON again, then replace the fuse if needed, and troubleshoot the system as required

   (NOTE: Replacing a fuse and system troubleshooting are covered by job sheets that accompany this unit of instruction.)

XIX. **ML92 interfaces** (Transparency 8)

A. The standard interface for the ML92 is a parallel interface that is centronics compatible and uses a 36-pin connector at the printer side and a 36-pin plug at the cable side

B. The printer cable should not be over 10 feet long, and it should be a shielded cable composed of twisted-pair wires to help noise prevention

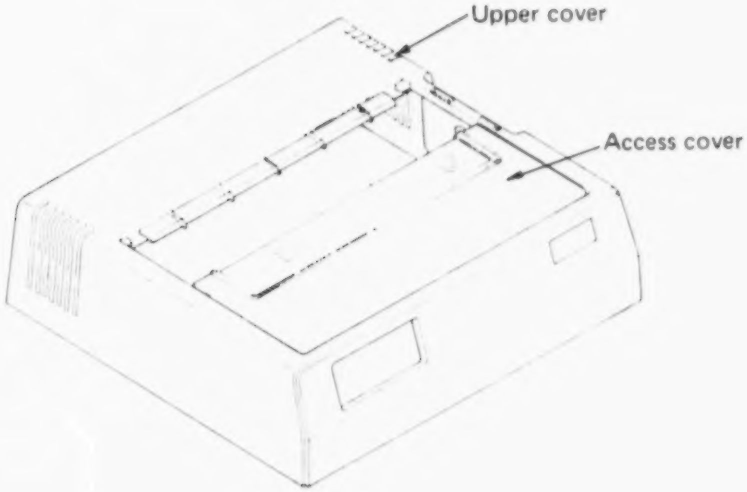
C. Optional interface boards may be installed as required:

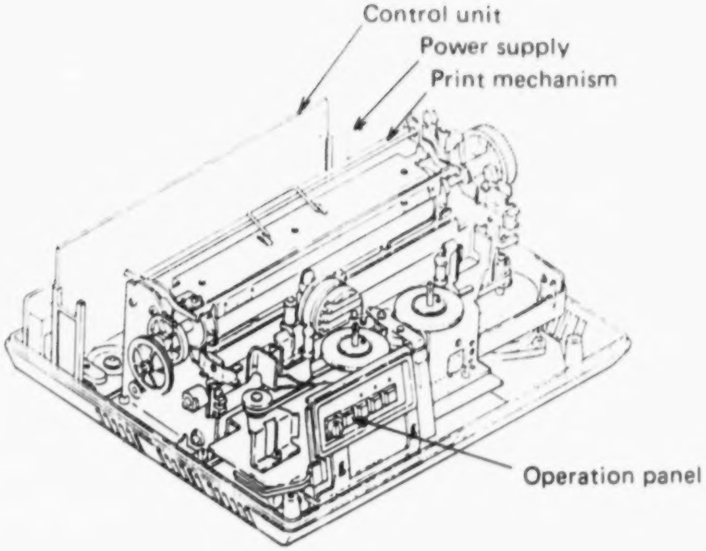
1. A high-speed (9600 BPS) RS-232C interface with 7 protocols

2. A current-loop interface

3. An IEEE 488 interface

ML92 Components


Upper cover
Access cover


Control unit
Power supply
Print mechanism
Operation panel

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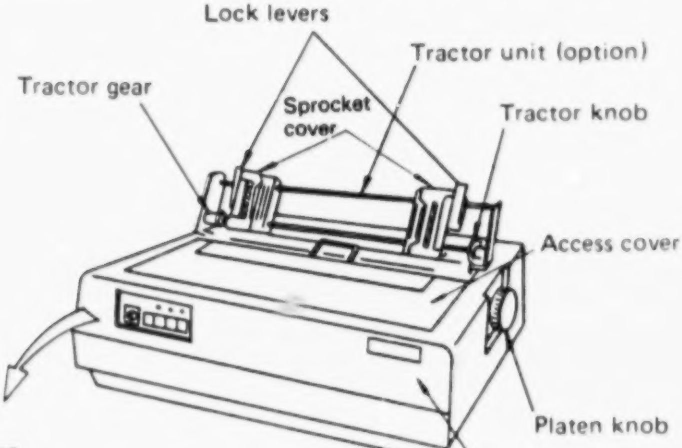
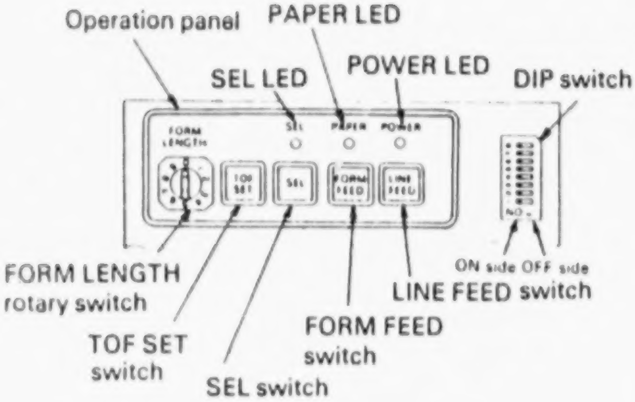
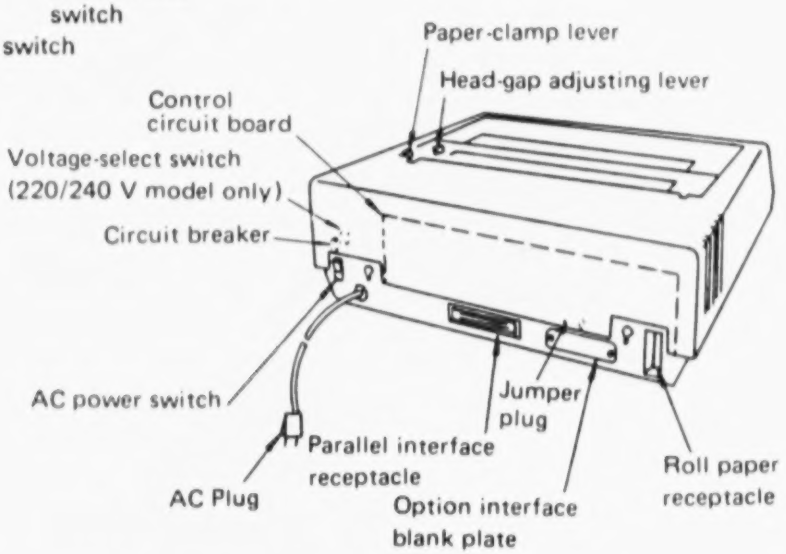
ML92 Controls and Indicators


Lock levers
Tractor unit (option)
Tractor gear
Sprocket cover
Tractor knob
Access cover
Platen knob
Lower cover
Upper cover


Operation panel
PAPER LED
SEL LED
POWER LED
DIP switch
FORM LENGTH
SEL
PAPER
POWER
TOF SET
SEL
FORM FEED
LINE FEED
ON side
OFF side
FORM LENGTH rotary switch
TOF SET switch
SEL switch
FORM FEED switch
LINE FEED switch


Paper-clamp lever
Head-gap adjusting lever
Control circuit board
Voltage-select switch (220/240 V model only)
Circuit breaker
AC power switch
AC Plug
Jumper plug
Parallel interface receptacle
Option interface blank plate
Roll paper receptacle

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ML92 Switch Functions

Table 3-2 FORM LENGTH Rotary Switch

Switch position	FORM LENGTH	6 LPI	8 LPI
0	3 inches	18 lines	24 lines
1	3.5 inches	21 lines	28 lines
2	4 inches	24 lines	32 lines
3	5.5 inches	33 lines	44 lines
4	6 inches	36 lines	48 lines
5	7 inches	42 lines	56 lines
6	8 or 8.5 inches*	48 or 51 lines*	64 or 68 lines*
7	11 inches	66 lines	88 lines
8	12 inches	72 lines	96 lines
9	14 inches	84 lines	112 lines

*Selectable by DIP switch (See table 3-3.)

Table 3-3 DIP Switch Functions

SW No.	ON	OFF
SW1	Designate a character set. (See table 3-4.)	
SW2		
SW3		
SW4		
SW5	Designates the form length of 8.5 inches when the FORM LENGTH rotary switch is set to position 6.	Designates the form length of 8 inches when the FORM LENGTH rotary switch is set to position 6.
SW6	Designates that reception of a CR code causes data printing, auto carriage return, and one line feed.	Designates that reception of a CR code causes data printing and auto carriage return without line feed.
SW7	Designates that reception of DEL code causes printing of ■.	Designates that DEL code is ignored.
SW8	Designates an optional interface: RS-232C, IEEE 488, or current-loop interface.	Designates the standard interface: parallel interface only.

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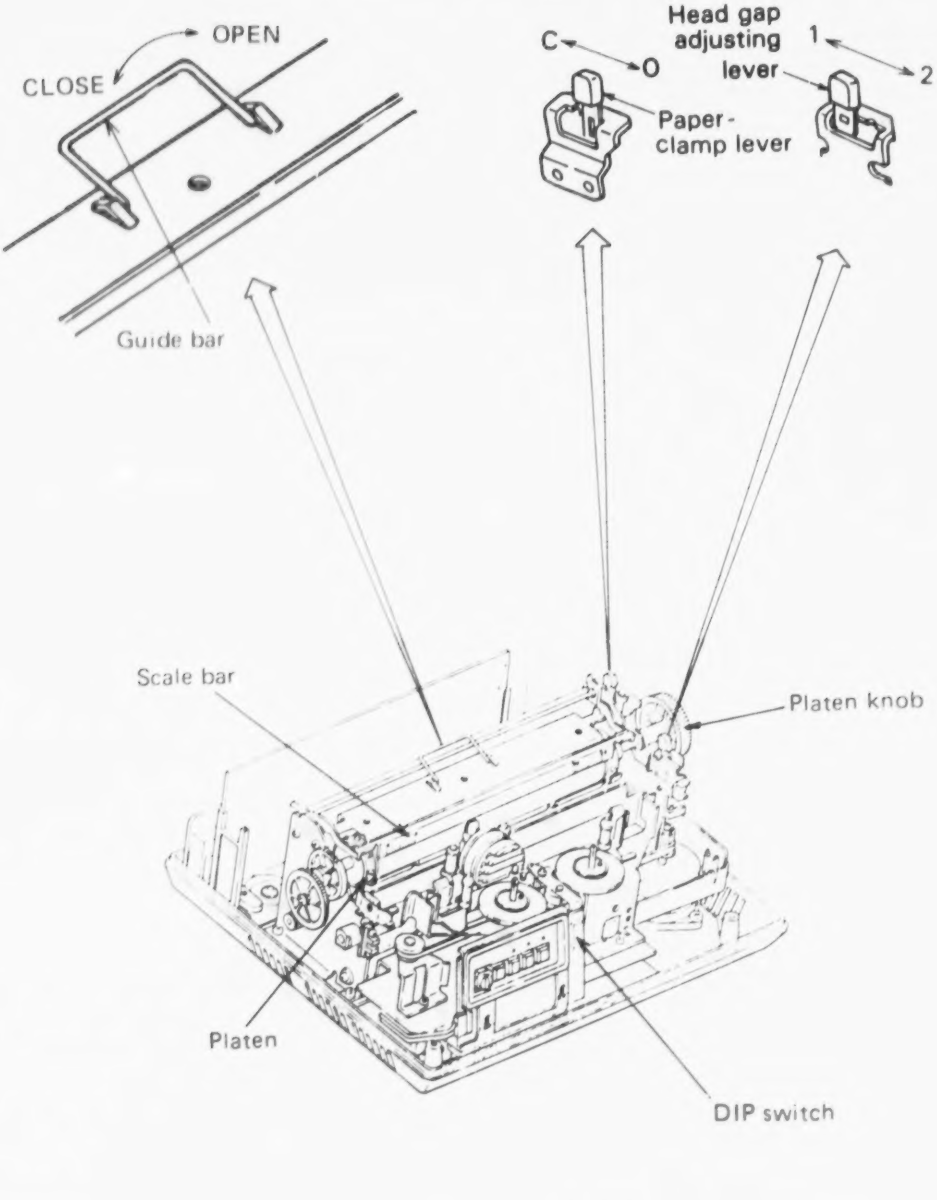
ML92 Mechanical Controls


OPEN
CLOSE
Guide bar
C
O
Head gap adjusting lever
1
2
Paper-clamp lever
Scale bar
Platen knob
Platen
DIP switch

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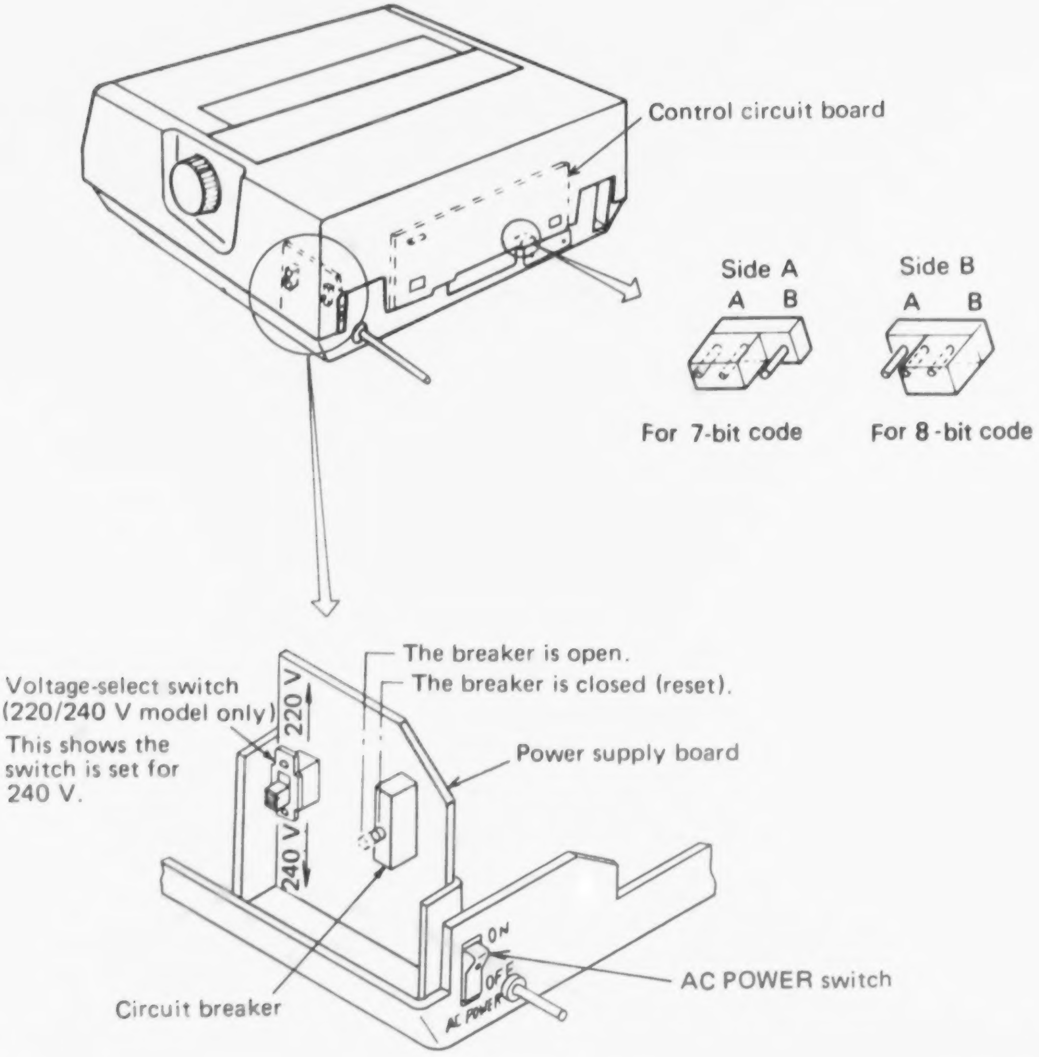
ML92 Selection and Protection Controls


Control circuit board
Side A
A B
For 7-bit code
Side B
A B
For 8 -bit code
The breaker is open.
The breaker is closed (reset).
Voltage-select switch
(220/240 V model only)
This shows the
switch is set for
240 V.
220 V
240 V
Power supply board
ON
OFF
AC POWER
AC POWER switch
Circuit breaker

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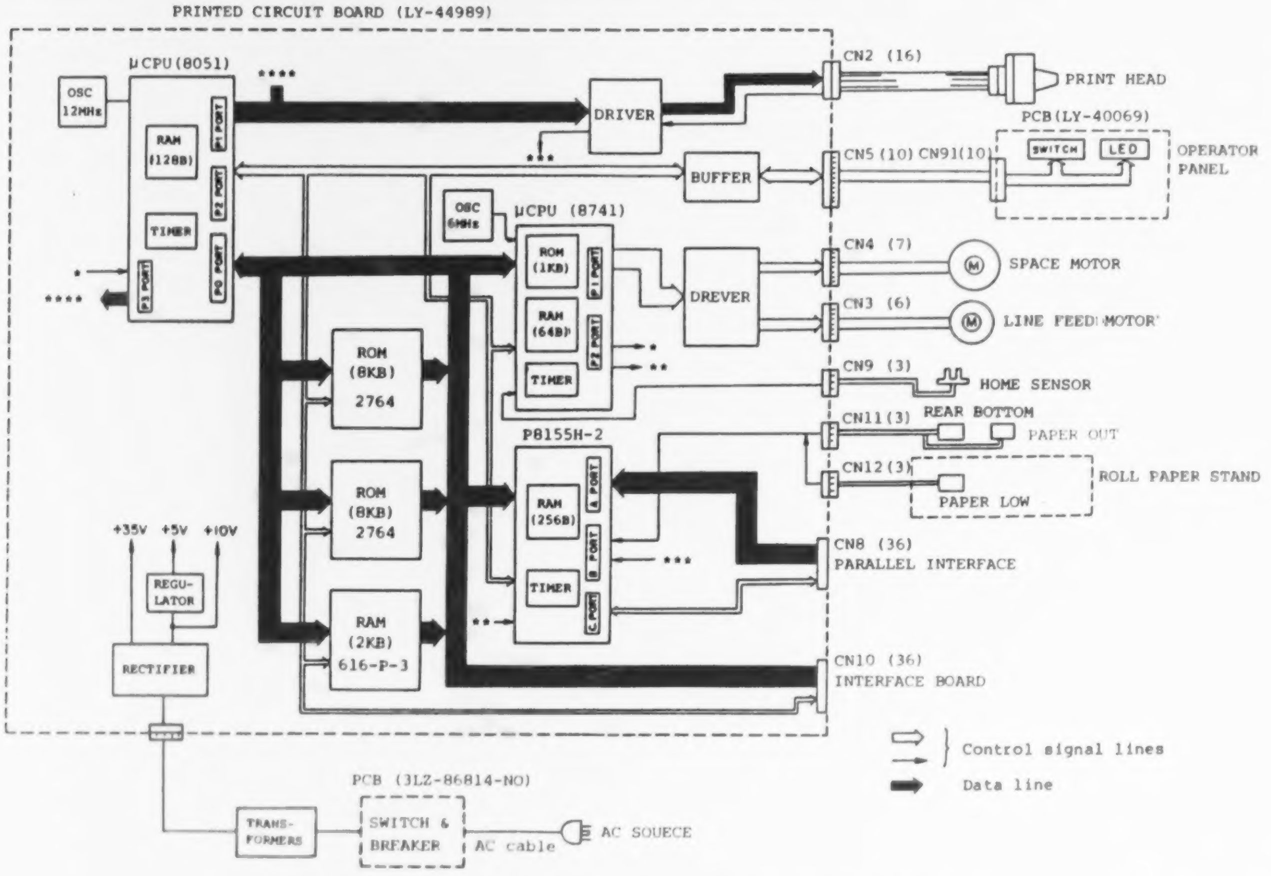
ML92 Control Board Features


PRINTED CIRCUIT BOARD (LY-44989)
μCPU(8051)
OSC 12MHz
RAM (128B)
TIMER
P1 PORT
P2 PORT
P0 PORT
P3 PORT
****
***
*
****
DRIVER
BUFFER
OSC 6MHz
μCPU (8741)
ROM (1KB)
RAM (64B)
TIMER
P1 PORT
P2 PORT
*
**
DREVER
ROM (8KB) 2764
ROM (8KB) 2764
RAM (2KB) 616-P-3
P8155H-2
RAM (256B)
TIMER
A PORT
B PORT
C PORT
***
**
+35V
+5V
+10V
REGU-LATOR
RECTIFIER
CN2 (16)
PRINT HEAD
PCB(LY-40069)
CN5 (10)
CN91(10)
SWITCH
LED
OPERATOR PANEL
CN4 (7)
SPACE MOTOR
CN3 (6)
LINE FEED MOTOR
CN9 (3)
HOME SENSOR
CN11(3)
REAR
BOTTOM
PAPER OUT
CN12(3)
PAPER LOW
ROLL PAPER STAND
CN8 (36)
PARALLEL INTERFACE
CN10 (36)
INTERFACE BOARD
Control signal lines
Data line
PCB (3LZ-86814-NO)
TRANS-FORMERS
SWITCH & BREAKER
AC cable
AC SOUECE

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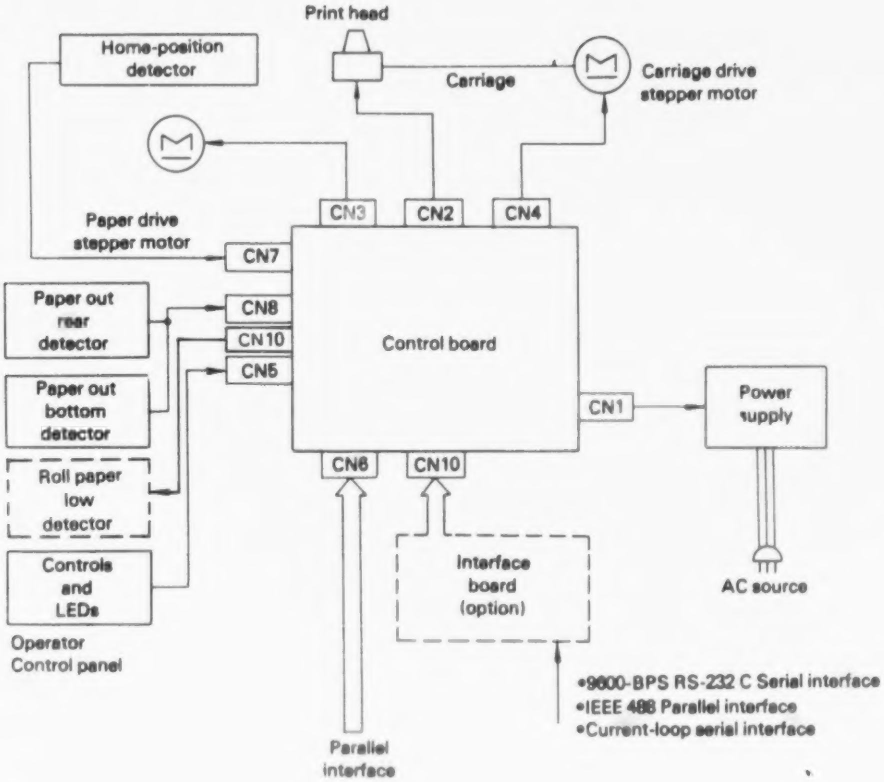
ML92 Block Diagram


Print head
Home-position detector
Carriage
Carriage drive stepper motor
Paper drive stepper motor
CN3
CN2
CN4
CN7
Paper out rear detector
CN8
CN10
CN5
Control board
Paper out bottom detector
CN1
Power supply
Roll paper low detector
CN6
CN10
Controls and LEDs
Interface board (option)
AC source
Operator Control panel
•9600-BPS RS-232 C Serial interface
•IEEE 488 Parallel interface
•Current-loop serial interface
Parallel interface

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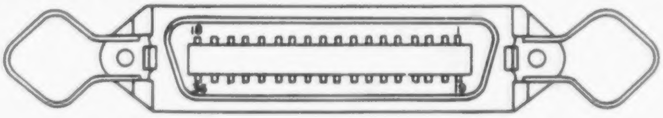
ML92 Parallel Interface Signals

Pin No.	Signal	Direction	Description
1	$\overline{\text{DATA STROBE}}$	TO PRINTER	When this signal changes from low to high level, input data are sampled.
2	DATA BIT 1	TO PRINTER	Data lines. The high level represents 1, and the low level represents 0.
3	DATA BIT 2		
4	DATA BIT 3		
5	DATA BIT 4		
6	DATA BIT 5		
7	DATA BIT 6		
8	DATA BIT 7		
9	DATA BIT 8		
10	$\overline{\text{ACKNOWLEDGE}}$	FROM PRINTER	The low level of this signal indicates completion of data input or function operation.
11	BUSY	FROM PRINTER	The high level of this signal indicates that the printer cannot receive data. The low level of this signal indicates that the printer is ready for receiving data.
12	PAPER END	FROM PRINTER	The high level of this signal indicates that the paper has run out.
13	SELECT	FROM PRINTER	The high level of this signal indicates that the printer is in select (online) state.
14,16 33	0V	–	Signal ground
17	CHASSIS GROUND	–	Frame ground
18	+5V	FROM PRINTER	+5 V supply (50 mA maximum)
19 ~ 30	0V		Return for the twisted-pair wires of pins 1 to 11
31	$\overline{\text{INPUT PRIME}}$	TO PRINTER	When this signal goes to low level, the printer controller is initialized. The low level should be held for more than 0.5 ms.
32	$\overline{\text{Fault}}$	FROM PRINTER	When the printer runs out of paper, this signal changes from high to low level.
15,34 35,36		–	Not used.

Note: Connector pin arrangement



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SERVICING AND REPAIRING DOT-MATRIX PRINTERS
UNIT II

JOB SHEET #1 — INSTALL PAPER FEEDING DEVICES ON AN ML92 PRINTER

A. Tools and equipment

1. Printer as selected by instructor
2. Maintenance manual
3. Tractor unit for printer
4. Roll paper stand for printer

B. Procedure for installing tractor unit

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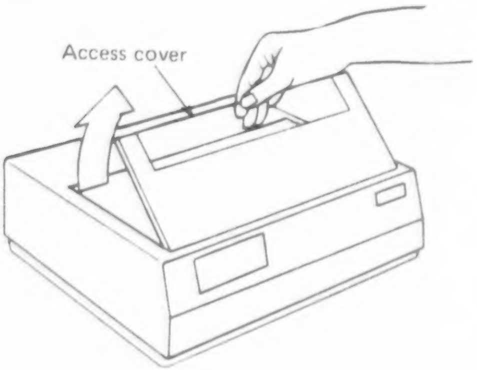
1. Sign on the troubleshooting log that accompanies this job sheet, and be sure to save the log for use with the other job sheets that follow
2. Set the printer on a clean work area with plenty of room to work and turn the AC power switch OFF
3. Remove the access cover (Figure 1)

FIGURE 1



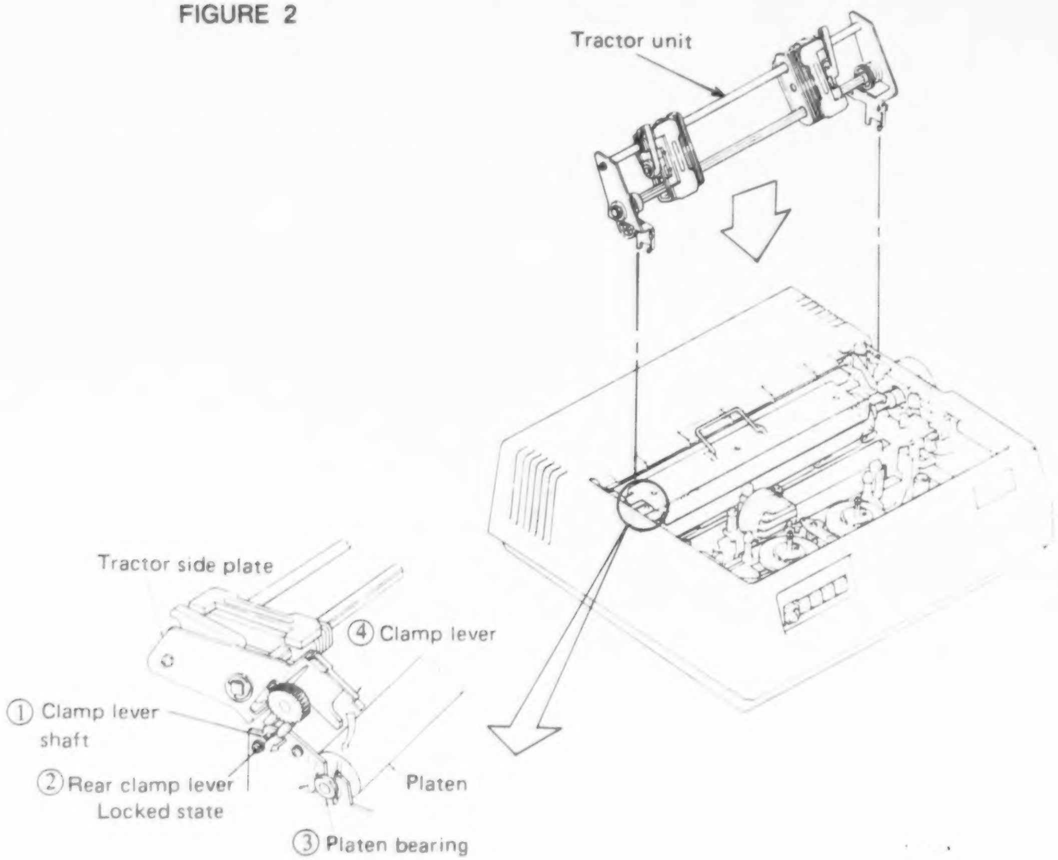
JOB SHEET #1

4. Install the tractor unit with the following procedure (Figure 2):

    a. Hold the unit with both hands as you slip the tractor unit rear clamp lever on the printer clamp lever shaft

    b. Engage the tractor unit clamp lever with the printer bearing

FIGURE 2


Tractor unit
Tractor side plate
④ Clamp lever
① Clamp lever shaft
② Rear clamp lever
Locked state
Platen
③ Platen bearing

5. Have your instructor check your installation

6. Remove the tractor unit by reversing the installation procedure

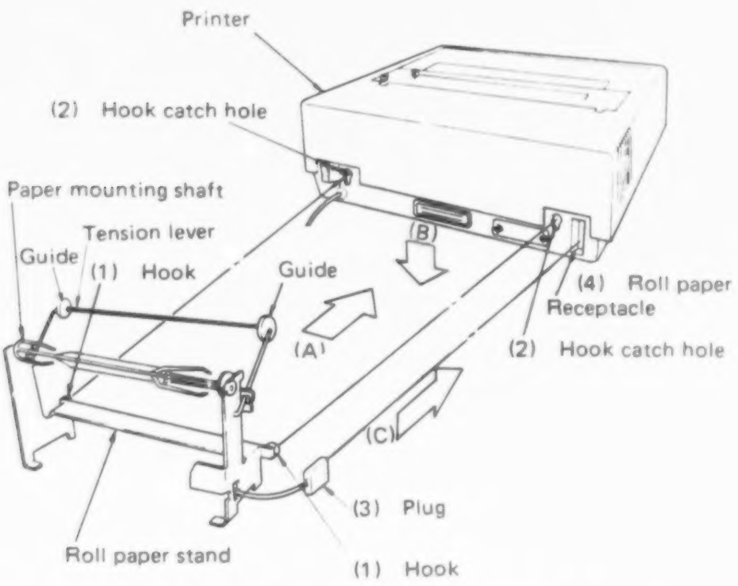
C. Procedure for installing and removing a roll paper stand (Figure 3)

1. Insert the left and right hooks of the roll paper stand into their proper hook catch holes at the back of the printer, and slide the roll stand forward so that it fastens to the printer

JOB SHEET #1

2. Connect the plug of the roll paper stand into the receptacle at the printer

FIGURE 3


Printer
(2) Hook catch hole
Paper mounting shaft
Tension lever
Guide
(1) Hook
Guide
(B)
(A)
(4) Roll paper Receptacle
(2) Hook catch hole
(C)
(3) Plug
Roll paper stand
(1) Hook

3. Have your instructor check your installation

4. Remove the roll paper stand by reversing the installation procedure

5. Sign off your troubleshooting log

6. Clean up area and return tools and equipment to proper storage, or prepare for next job sheet as directed by your instructor

   (NOTE: Installing the tractor unit and roll paper stand is an activity that will be repeated in another job sheet, but repeating the activity will be good practice because it's part of the testing required after a printer has been repaired.)

JOB SHEET #1

Troubleshooting and Repair Log

Customer's Name ______________________________ Invoice __________________

Date ____________________ Equipment and Serial # ______________________________

Complaint ____

____

Technician's Name & ID #	Date	Time On	Time Off	Work Performed	Replacement Parts Used & Inventory #

SERVICING AND REPAIRING DOT-MATRIX PRINTERS
UNIT II

JOB SHEET #2 — REMOVE THE UPPER CASE ON AN ML92 PRINTER AND REPLACE THE SYSTEM FUSE

A. Tools and equipment

1. Printer as selected by instructor
2. Maintenance manual
3. Phillips head screwdrivers
4. 2.5 amp replacement fuse
5. Cleaning equipment
6. VOM or DVOM (optional)
7. Troubleshooting log

B. Procedure

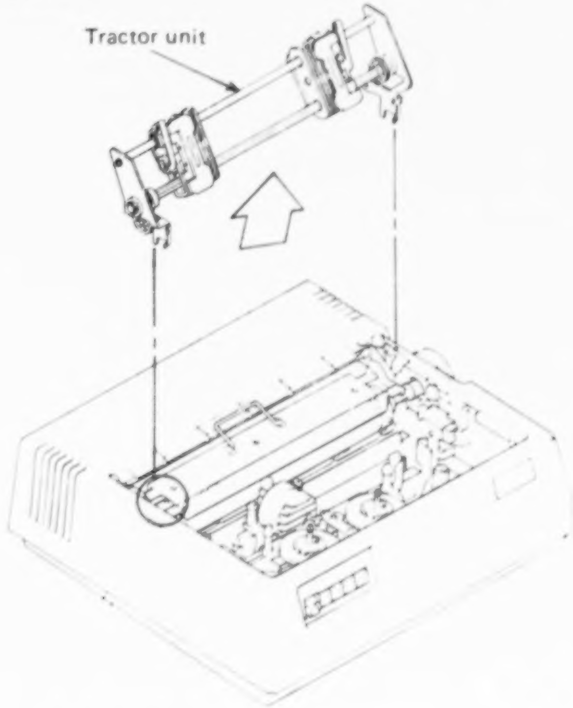
> NOTE: The following procedures and illustrations are adapted from materials copyrighted ©1985 **OKIDATA, Division of OKI AMERICA, Inc.** Limited permission to copy granted by **OKIDATA** to **MAVCC.** Unauthorized use or reproduction will be prosecuted within the full extent allowable by law.

1. Sign on your troubleshooting log (log should have been saved from Job Sheet #1)
2. Turn OFF the AC power switch and remove the AC cable plug from the receptacle

JOB SHEET #2

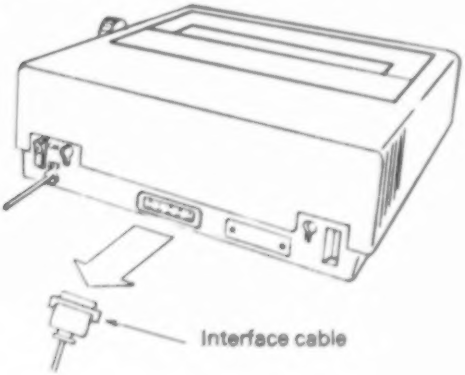
3. Remove the tractor unit (Figure 1)

FIGURE 1


Tractor unit

4. Remove the interface cable from the printer (Figure 2)

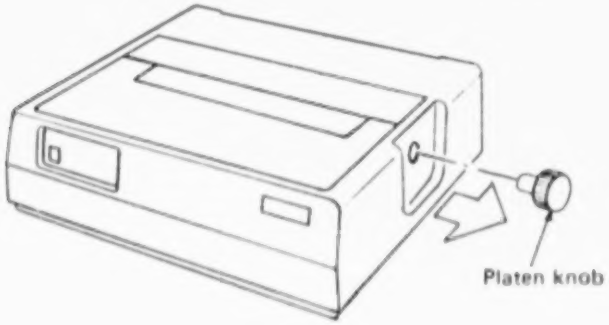
FIGURE 2


Interface cable

JOB SHEET #2

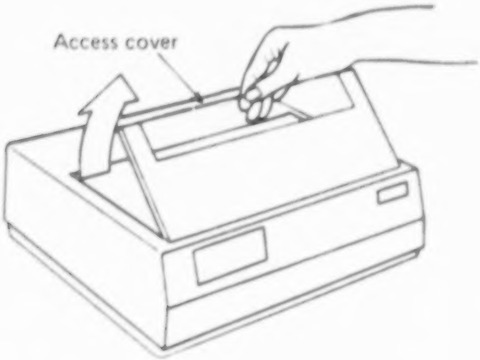
5. Remove the platen knob (Figure 3)

FIGURE 3


Platen knob

6. Remove the access cover (Figure 4)

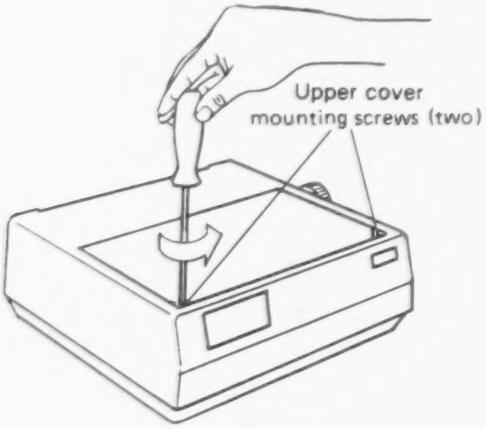
FIGURE 4


Access cover

JOB SHEET #2

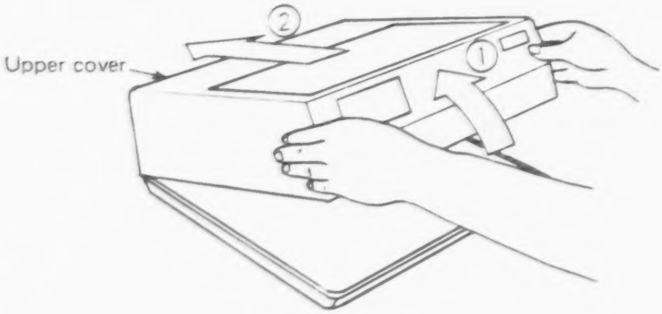
7. Remove the screws on each side of the upper case (Figure 5)

FIGURE 5


Upper cover
mounting screws (two)

8. Lift the front of the upper case, tilt it backward, then lift it off the lower case (Figure 6)

FIGURE 6


②
①
Upper cover

9. Place the two upper case mounting screws safely aside or put them back where they came from until time to replace the upper case

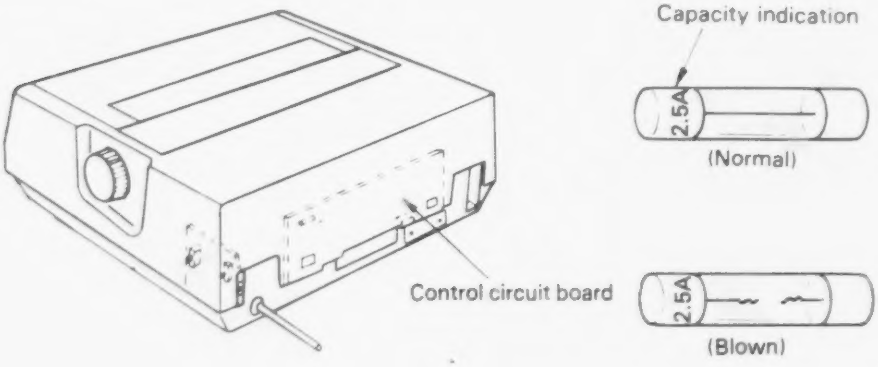
10. Inspect the interior of the printer for lint or dirt and clean as required

JOB SHEET #2

11. Have your instructor check your upper case removal

12. Look at the back of the printer and locate the control circuit board and check the system fuse (Figure 7)

FIGURE 7



13. Replace the system fuse with a known good 2.5 amp fuse if the fuse is blown

    (**CAUTION:** Even if the fuse appears to be okay, it's not a bad idea to make a resistance check with an ohmmeter.)

14. Replace the upper case and access cover by reversing the procedures used to remove them

15. Have your instructor check your work

16. Sign off your troubleshooting log

17. Clean up area and return tools and equipment to proper storage area, or prepare for next job sheet as directed by your instructor

    (NOTE: When future job sheets indicate you should remove or replace the upper case or access cover, it is a reference to the activities you've just completed here.)

SERVICING AND REPAIRING DOT-MATRIX PRINTERS
UNIT II

JOB SHEET #3 — REPLACE A RIBBON AND INSTALL CUT-SHEET, ROLL, AND SPROCKET-FED PAPER ON AN ML92 PRINTER

A. Tools and equipment

1. Printer as selected by instructor
2. Maintenance manual
3. Screwdriver set
4. Replacement ribbon
5. Cut-sheet, roll, and sprocket-fed paper supply as needed
6. Vacuum, brushes, or cleaning tools as required

B. Procedure for replacing a ribbon

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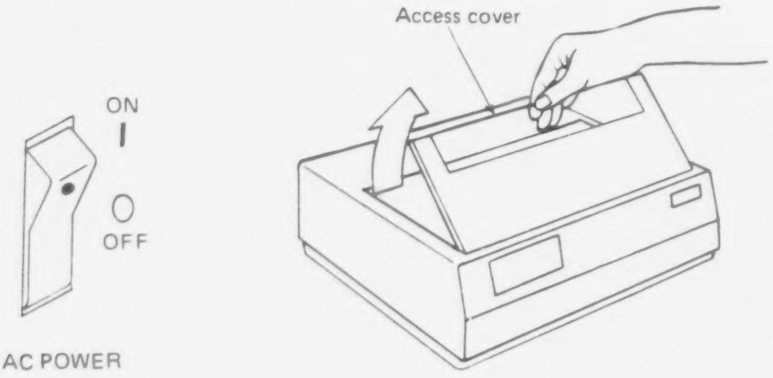
1. Sign on your troubleshooting log, and be sure to sign off the log at the end of this job sheet or at whatever point you may stop in the job sheet
2. Turn the AC power switch OFF and remove the access cover (Figure 1)

FIGURE 1

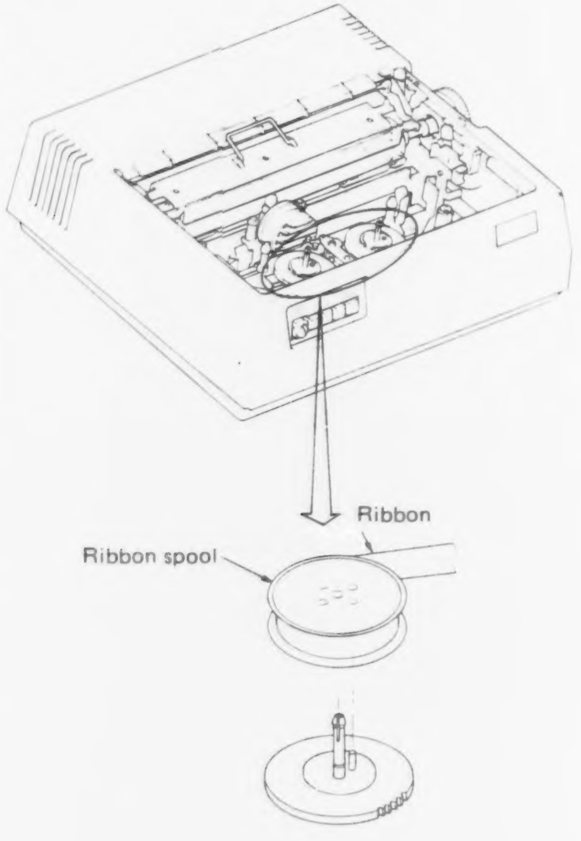


JOB SHEET #3

3. Remove the used ribbon spools, then remove the used ribbon on one spool and save the empty spool (Figure 2)

   (NOTE: Here, or before the ribbon is replaced, whatever cleaning is needed around the ribbon spools or along the ribbon path should be completed.)

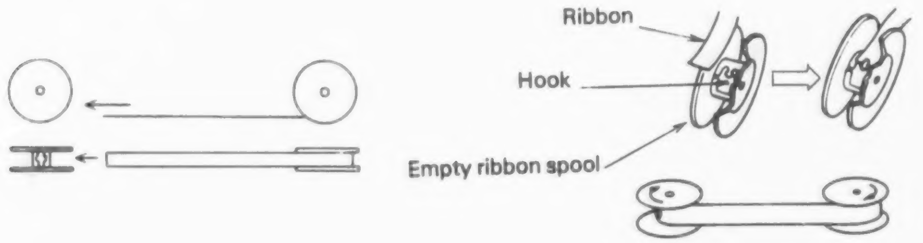
FIGURE 2



JOB SHEET #3

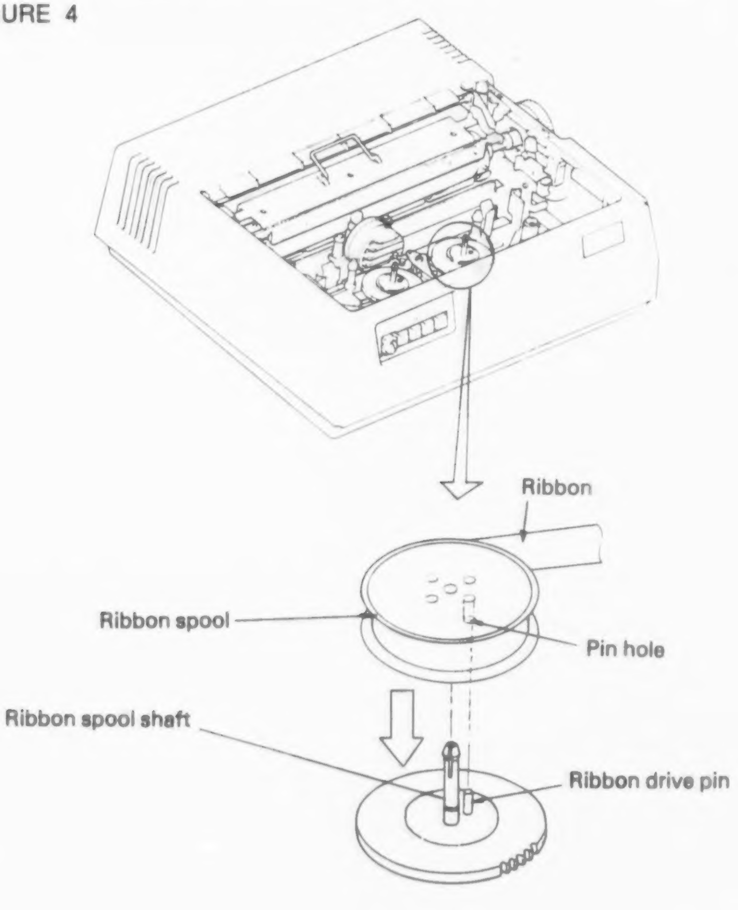
4. Loosen the end of a new ribbon, then attach the ribbon to the hook on the empty spool boss and wind it onto the empty spool a few turns (Figure 3)

FIGURE 3


Ribbon
Hook
Empty ribbon spool

5. Mount the inside spool on the spool shaft so that the ribbon drive pin fits into the pin hole in the spool and the new ribbon will feed to the right for threading through the ribbon guide mechanism (Figure 4)

FIGURE 4


Ribbon
Ribbon spool
Pin hole
Ribbon spool shaft
Ribbon drive pin

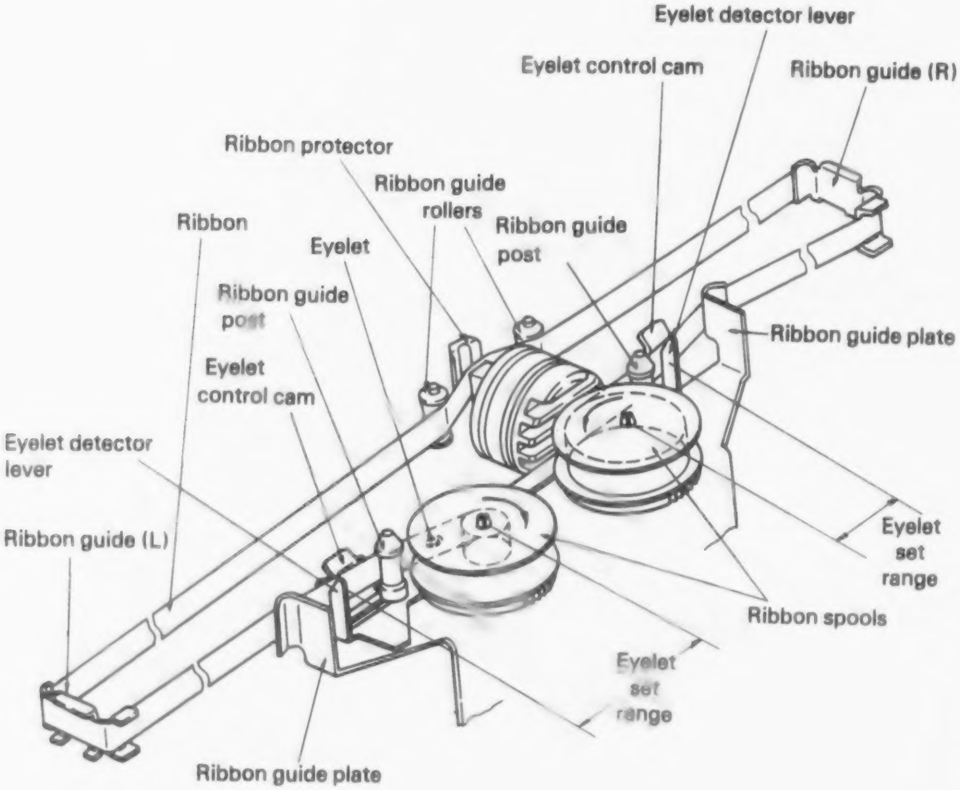
JOB SHEET #3

6. Thread the new ribbon carefully so that it does not twist or fold as it passes through the parts of the ribbon guide system (Figure 5)

    a. Thread ribbon as illustrated in Figure 5 so that it passes over the right ribbon guide over the ribbon guide rollers and ribbon protector at the printhead, and then over the left ribbon guide

    b. Note that the eyelet on the end of the new ribbon must go past the eyelet control cam on the left or outside spool so the cam can control the tape rewind function

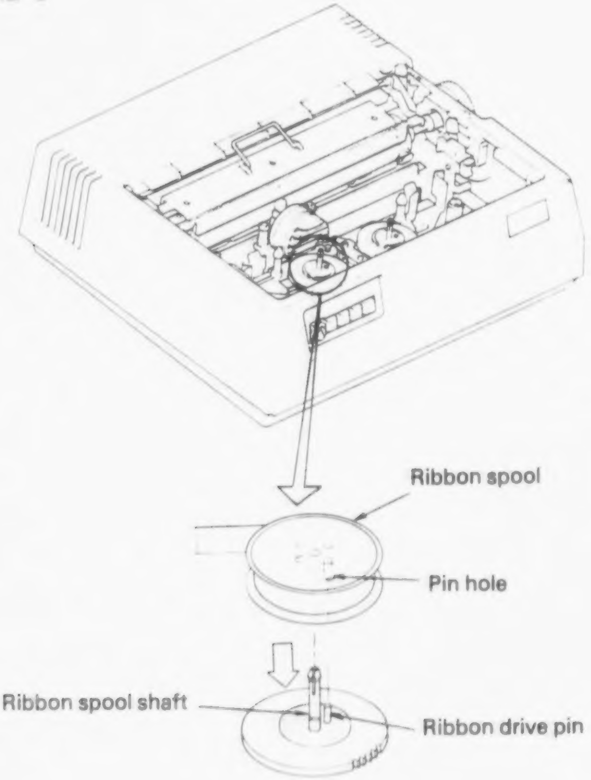
FIGURE 5


Eyelet detector lever
Eyelet control cam
Ribbon guide (R)
Ribbon protector
Ribbon guide rollers
Ribbon
Ribbon guide post
Eyelet
Ribbon guide post
Ribbon guide plate
Eyelet control cam
Eyelet detector lever
Ribbon guide (L)
Eyelet set range
Ribbon spools
Eyelet set range
Ribbon guide plate

JOB SHEET #3

7. Mount the outside spool onto the spool shaft so that the ribbon drive pin fits into the pin hole in the spool (Figure 6)

FIGURE 6


Ribbon spool
Pin hole
Ribbon spool shaft
Ribbon drive pin

8. Make sure the outside spool is in place, then turn the ribbon spool to take up slack in the ribbon

9. Have your instructor check your ribbon installation

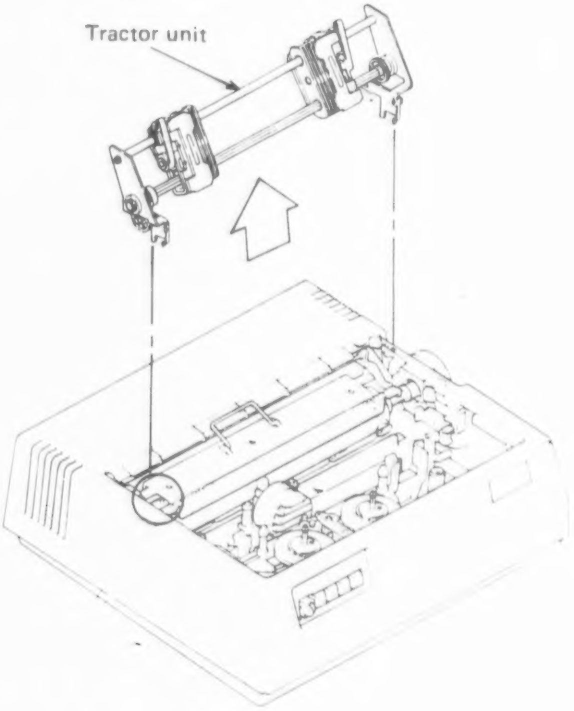
   (NOTE: If you were only replacing a ribbon, the access cover would be replaced at this point, but for now, leave it off and continue with the following procedures for loading the Microline 92 with paper.)

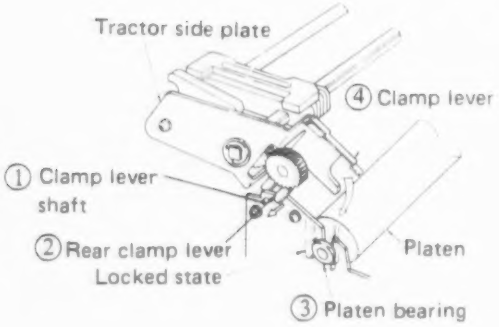
JOB SHEET #3

C. Procedure for installing cut-sheet paper

1. Remove the tractor unit from the printer as outlined in a previous job sheet (Figure 7)

FIGURE 7

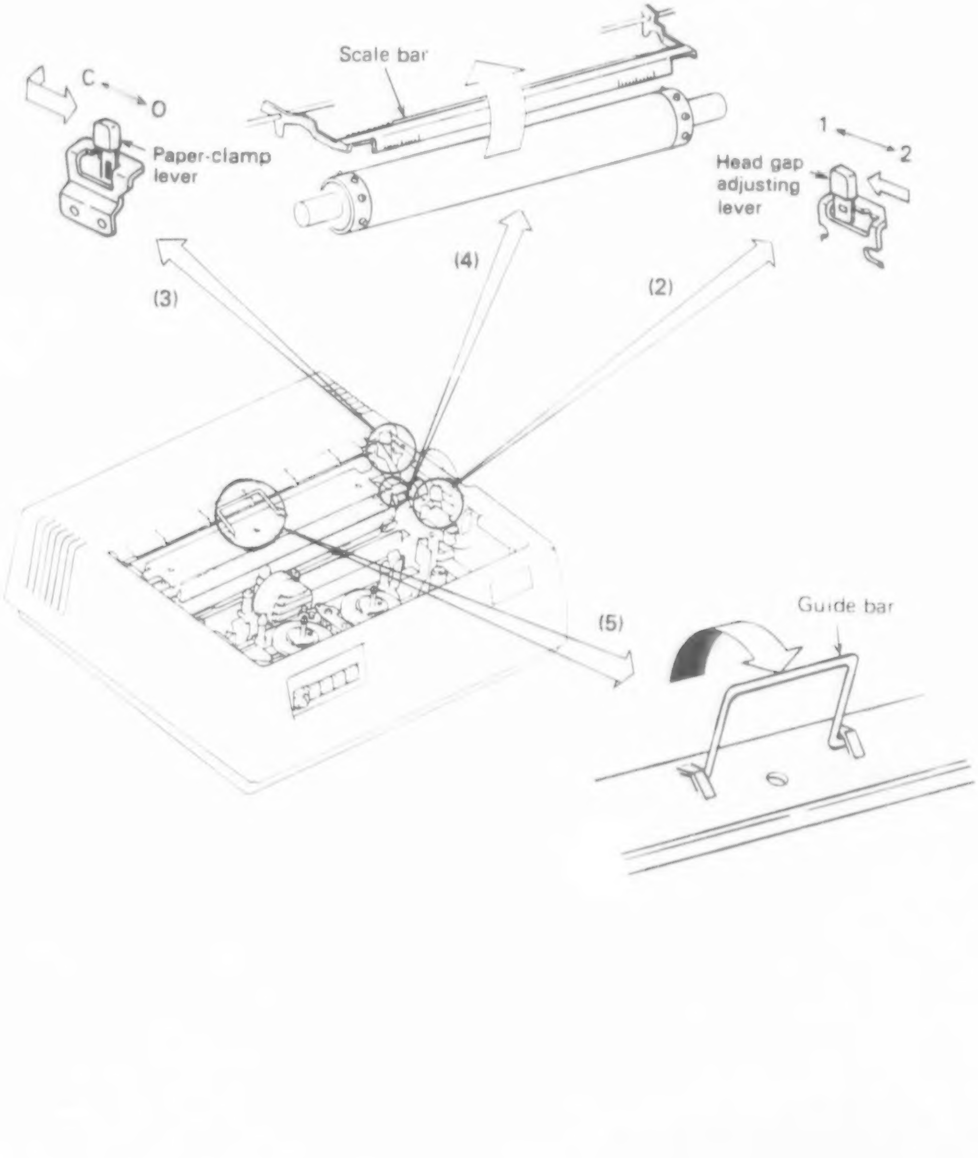

Tractor unit


Tractor side plate
④ Clamp lever
① Clamp lever shaft
② Rear clamp lever
Locked state
Platen
③ Platen bearing

JOB SHEET #3

2. Make the following adjustments (Figure 8)
   a. Set the head-gap adjusting lever to position 1
   b. Set the paper-clamp lever to open or 0
   c. Open the scale bar
   d. Stand the guide bar upright

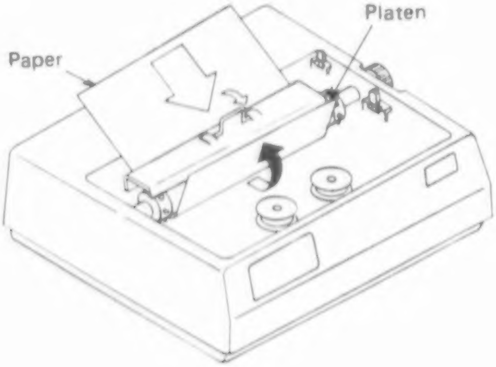
FIGURE 8


Scale bar
C
O
Paper-clamp lever
1
2
Head gap adjusting lever
(4)
(3)
(2)
(5)
Guide bar

JOB SHEET #3

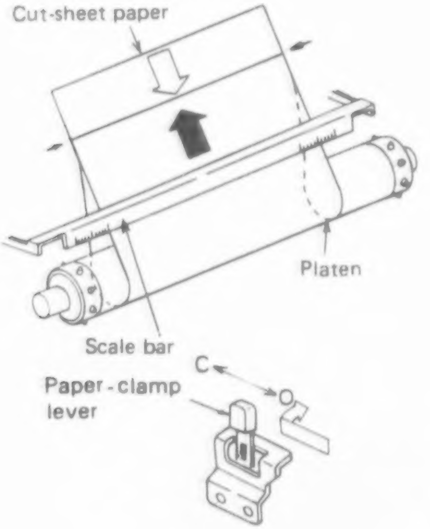
3. Insert paper from the back of the platen until it reaches the front of the platen (Figure 9)

FIGURE 9


Paper
Platen

4. Guide the paper under the scale bar, align the paper, and then close the paper-clamp lever by setting it to C (Figure 10)

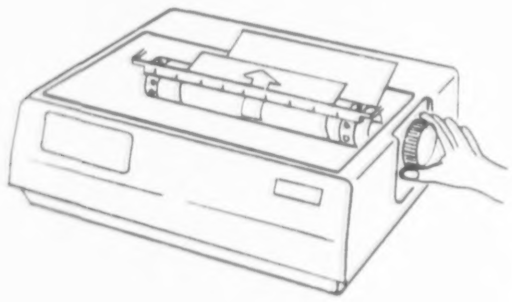
FIGURE 10


Cut-sheet paper
Platen
Scale bar
C
O
Paper-clamp lever

JOB SHEET #3

5. Close the scale bar and turn the platen knob to feed the paper to the first printing line (Figure 11)

FIGURE 11



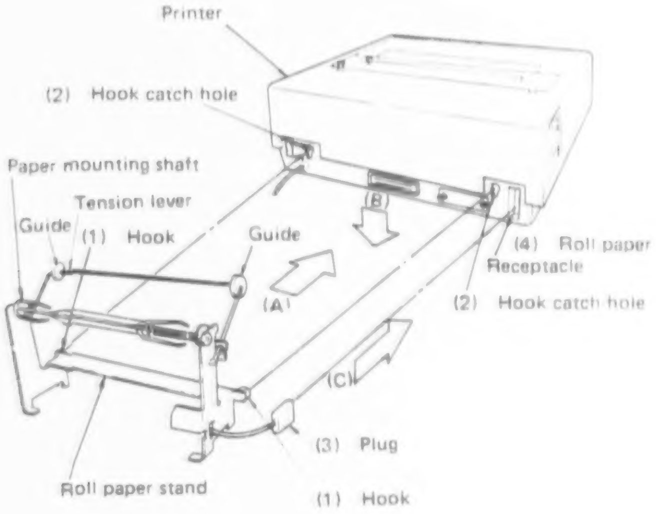
6. Have your instructor check your cut-sheet paper installation

(NOTE: In normal printer operations, the access cover would be replaced at this point, but for now, leave it off and remove the cut-sheet paper so you can practice installation procedures for roll paper.)

D. Procedure for installing roll paper

1. Remove the tractor unit from the printer and install the roll paper stand as outlined in a previous job sheet (Figure 12)

FIGURE 12

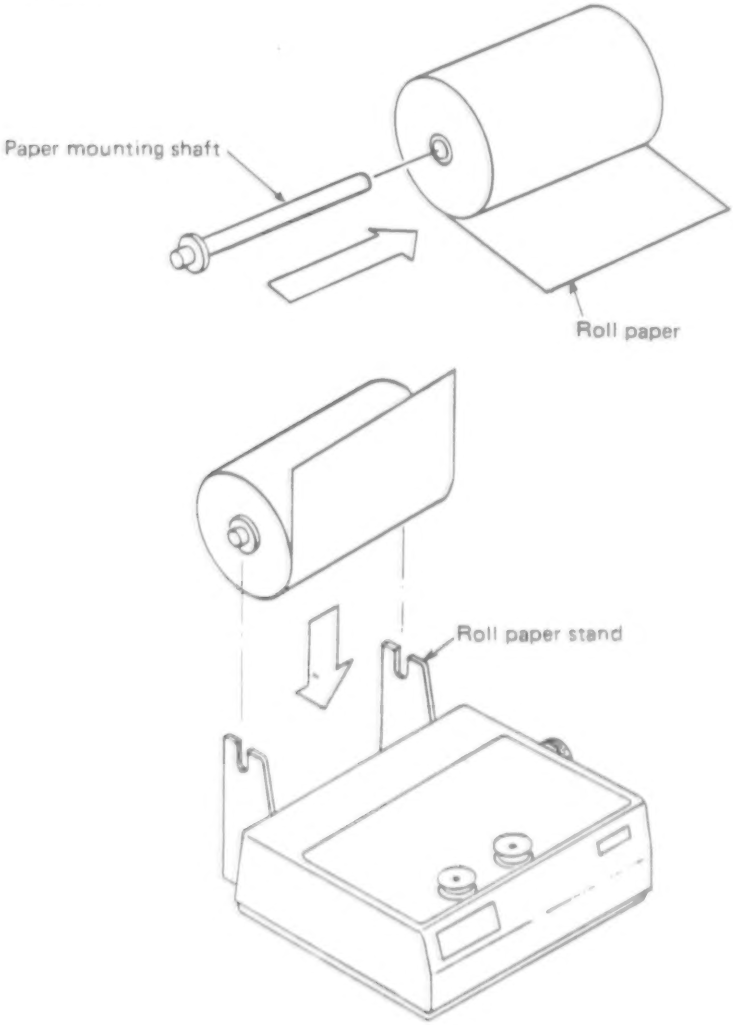

Printer
(2) Hook catch hole
Paper mounting shaft
Tension lever
Guide
(1) Hook
Guide
(B)
(A)
(4) Roll paper Receptacle
(2) Hook catch hole
(C)
(3) Plug
Roll paper stand
(1) Hook

Installation of Roll Paper Stand

JOB SHEET #3

2. Insert the paper mounting shaft into the roll paper core and mount it on the roll paper stand (Figure 13)

FIGURE 13


Paper mounting shaft
Roll paper
Roll paper stand

JOB SHEET #3

3. Make the following adjustments (Figure 14)

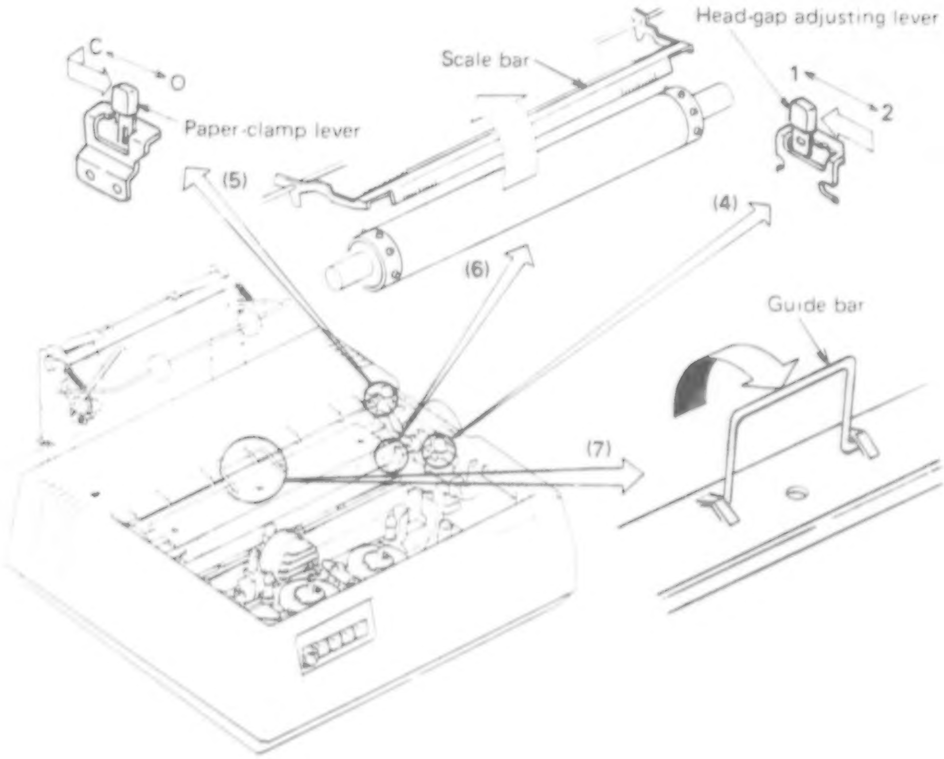
   a. Set the head-gap adjusting lever to position 1

   b. Set the paper-clamp lever to open or 0

   c. Open the scale bar

   d. Stand the guide bar upright

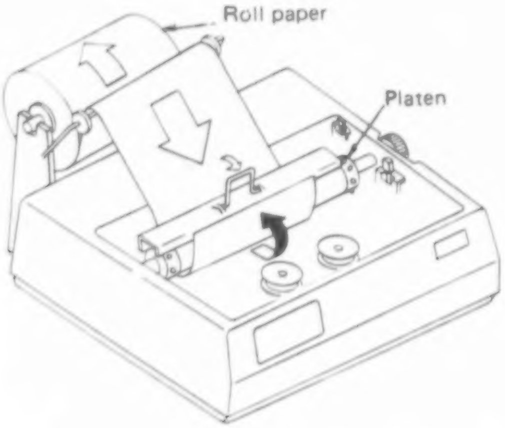
FIGURE 14

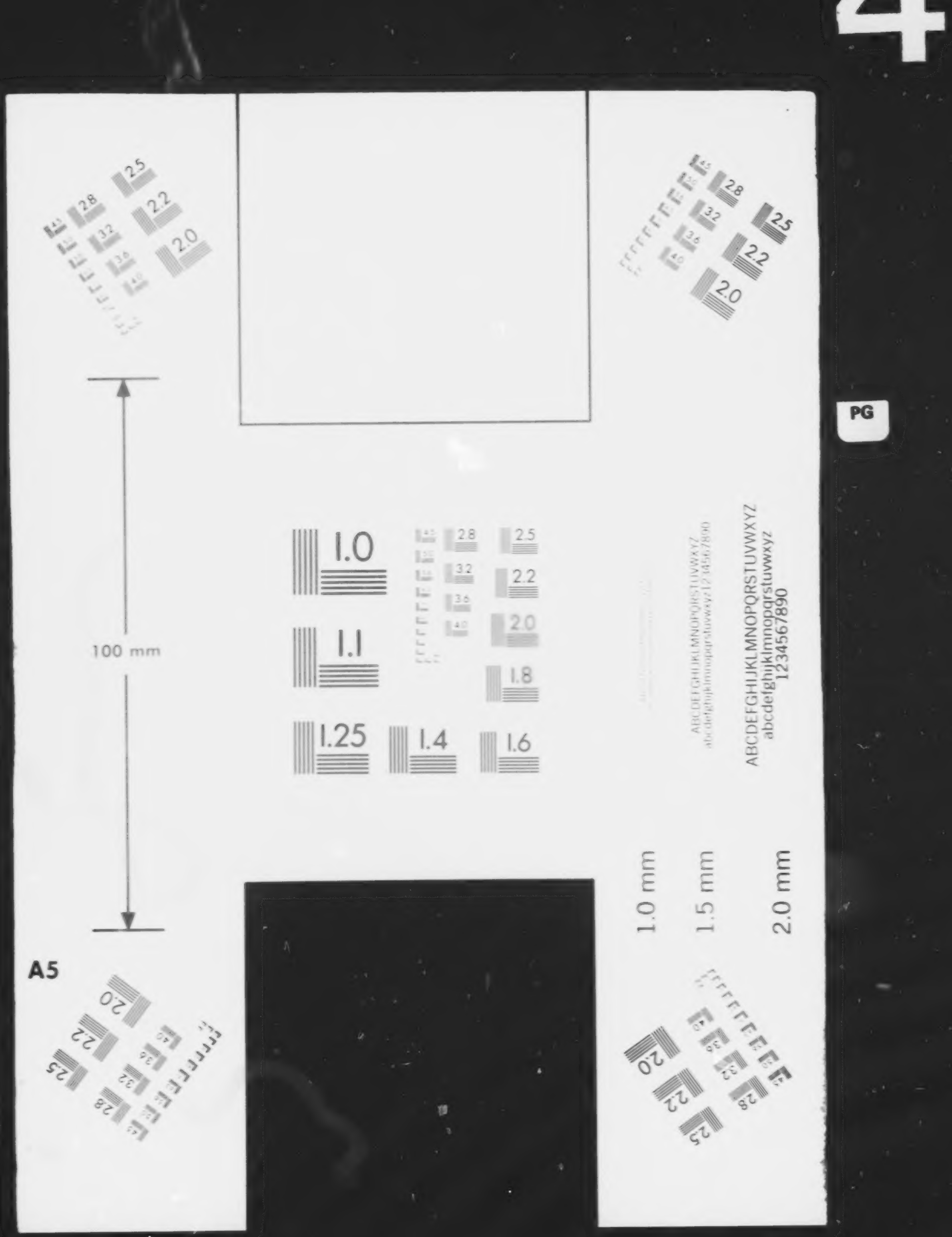

C
O
Paper-clamp lever
(5)
Scale bar
(6)
Head-gap adjusting lever
1
2
(4)
Guide bar
(7)

JOB SHEET #3

4. Insert the paper from the back of the platen until it reaches the front of the platen (Figure 15)

FIGURE 15


Roll paper
Platen

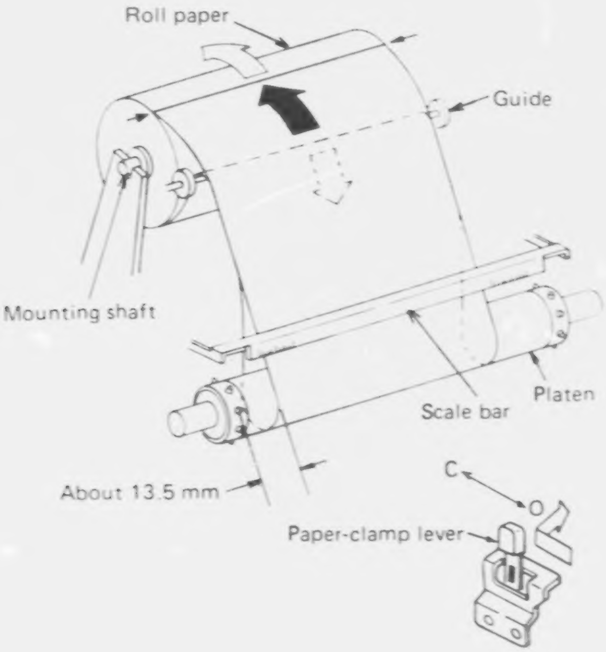

4
PG
A5
100 mm
1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz 1234567890
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890
1.0 mm
1.5 mm
2.0 mm

JOB SHEET #3

5. Put the guide bar down, guide the paper under the scale bar, align the paper, and then close the paper-clamp lever by setting it to C (Figure 16)

   (NOTE: The left edge of the paper should be about 13.5 mm or just a bit over 1/2" inside the left platen sprocket pin position.)

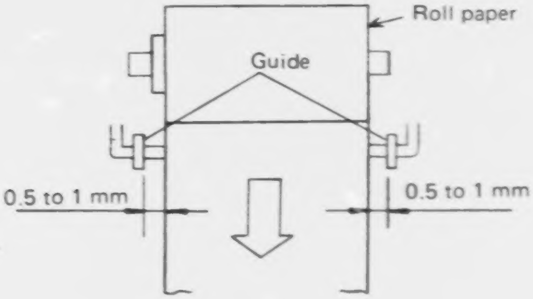
FIGURE 16


Roll paper
Guide
Mounting shaft
Platen
Scale bar
About 13.5 mm
C
O
Paper-clamp lever

JOB SHEET #3

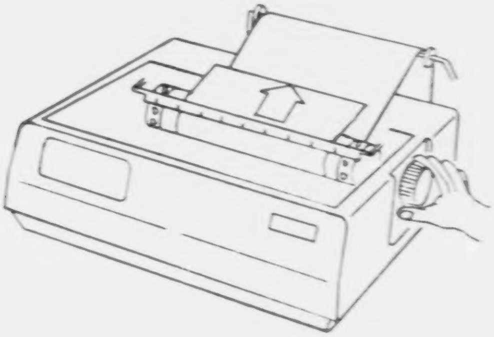
6. Close the scale bar and adjust the left and right guides of the paper roll stand so that the gap between the guide and the paper end is 0.5 to 1 mm or 0.02 to 0.04 inches (Figure 17)

FIGURE 17



7. Turn the platen knob to set the paper to the top-of-form position (Figure 18)

FIGURE 18



8. Have your instructor check your roll paper installation

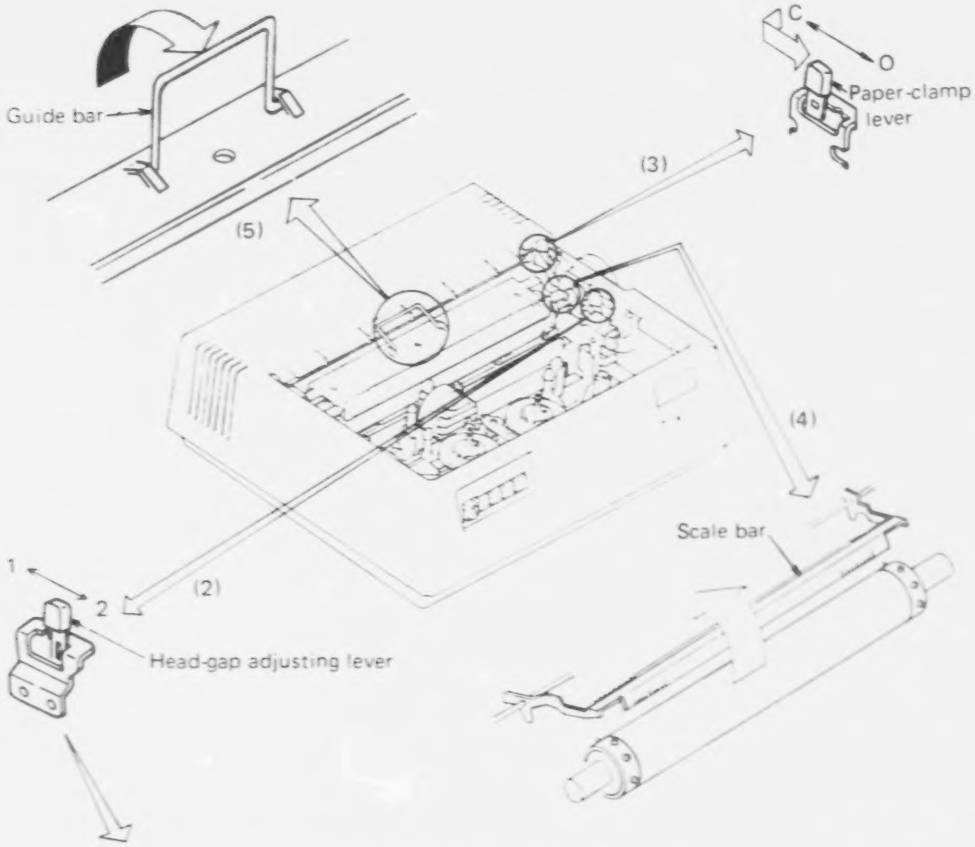
(NOTE: In normal operations, the access cover would be replaced at this point, but for now, leave it off and remove the roll paper from the printer so you can practice installation procedures for sprocket paper.)

JOB SHEET #3

E. Procedure for installing sprocket paper for use without a tractor unit

1. Make the following printer adjustments (Figure 19)
    a. Set the head-gap adjusting lever to position 1 or 2 as required by paper thickness and be sure you are using 9 ½" paper
    b. Set the paper-clamp lever to open or 0
    c. Open the scale bar, and if rear feed paper is being used, stand the guide bar upright

FIGURE 19



Head-Gap Adjusting Lever Setting

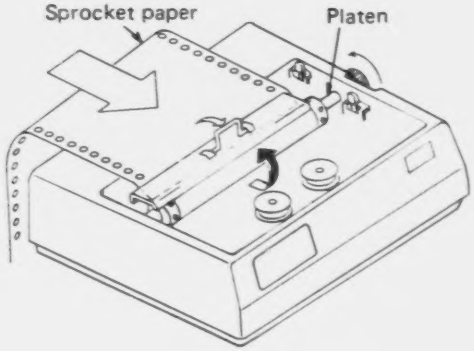
Head-gap adjusting lever position	Type of paper	No. of sheets
1 (Platen side: The gap between the platen and the print head is narrow.)	One-part paper	1
	Pressure-sensitive or carbon-lined paper	2 to 3
	Interleaf paper	2
2 (Front side: The gap between the platen and the print head is wide.)	Pressure-sensitive or carbon-lined paper	4
	Interleaf paper	3 to 4

JOB SHEET #3

2. Insert paper and then turn the platen knob until the paper reaches the front of the platen

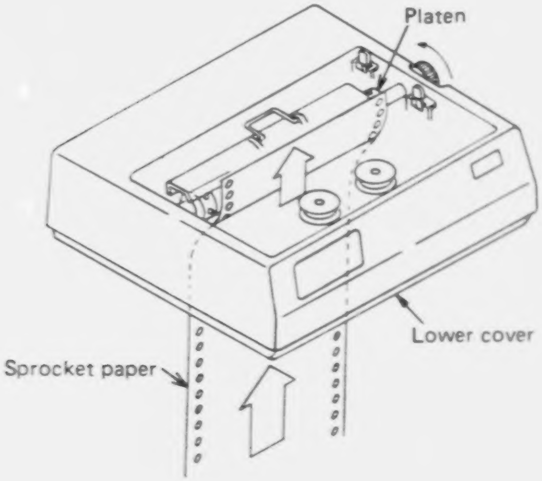
   a. For rear paper feed, insert paper from the back of the platen (Figure 20)

   FIGURE 20


Sprocket paper
Platen

   b. For bottom paper feed, insert paper from bottom of the printer lower cover (Figure 21)

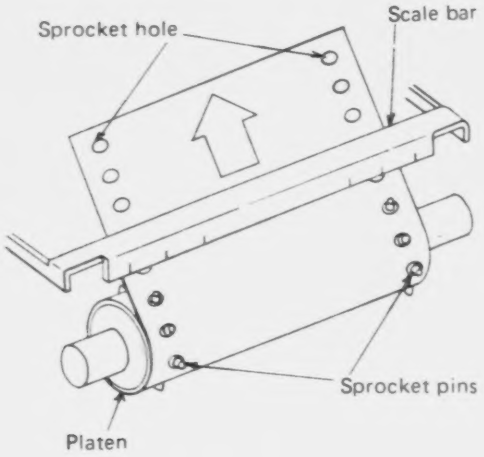
   FIGURE 21


Platen
Lower cover
Sprocket paper

JOB SHEET #3

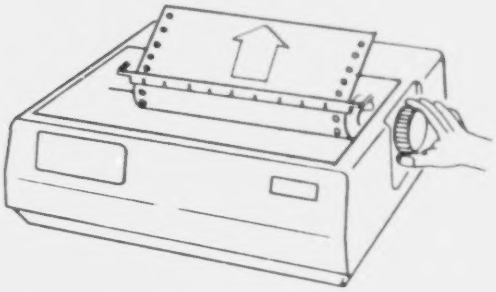
3. Guide the paper under the scale bar, turn the platen knob to advance the paper, and set the paper sprocket holes onto the sprocket pins of the platen (Figure 22)

FIGURE 22


Sprocket hole
Scale bar
Sprocket pins
Platen

4. Put the guide bar down and close the scale bar, and then turn the platen knob to adjust the paper to the top-of-form position, then gently move the paper back a bit to remove any slack (Figure 23)

FIGURE 23



JOB SHEET #3

5. Have your instructor check your sprocket paper installation without a tractor unit

   (NOTE: In normal operations, the access cover would be replaced at this point, but for now, leave it off and remove the sprocket paper from the printer so you can use it again to practice installing sprocket paper using a tractor unit.)

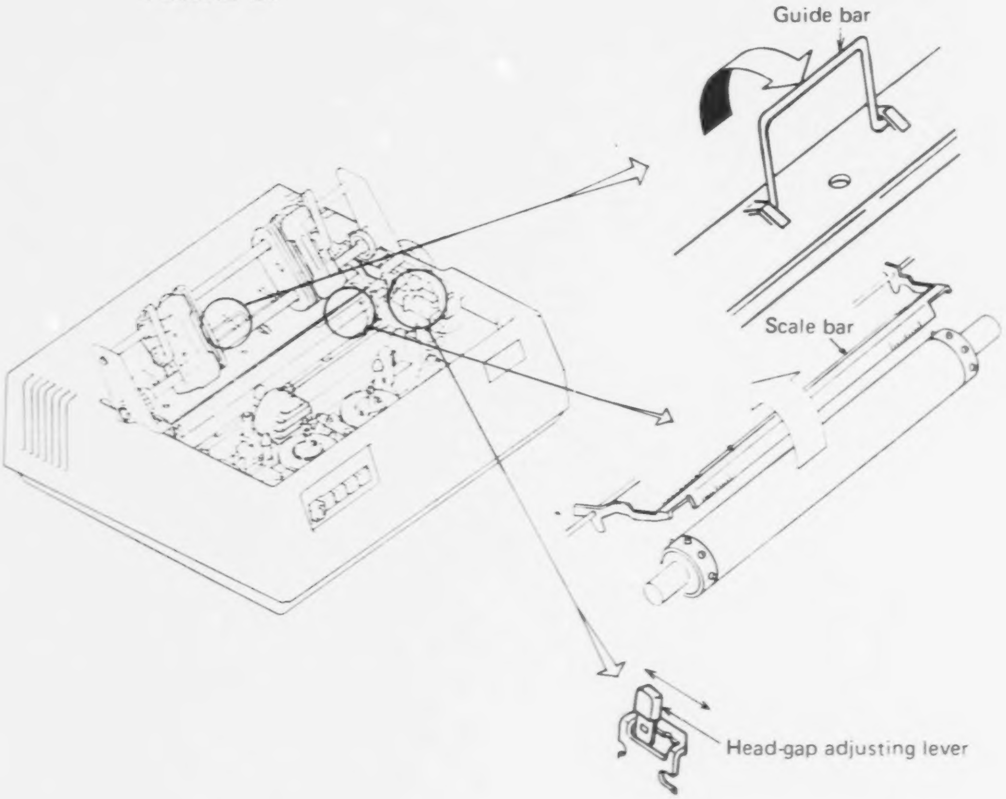
F. Procedure for installing sprocket paper for use with a tractor unit

1. Make the following printer adjustments (Figure 24)

   a. Set the head-gap adjustment to 1 or 2 depending on paper thickness, and open the scale bar

   b. Stand the guide bar upright for rear paper feed

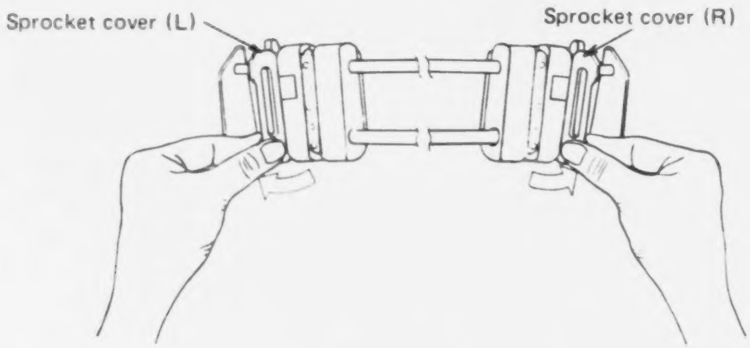
FIGURE 24



JOB SHEET #3

2. Open the sprocket covers of the tractor unit (Figure 25)

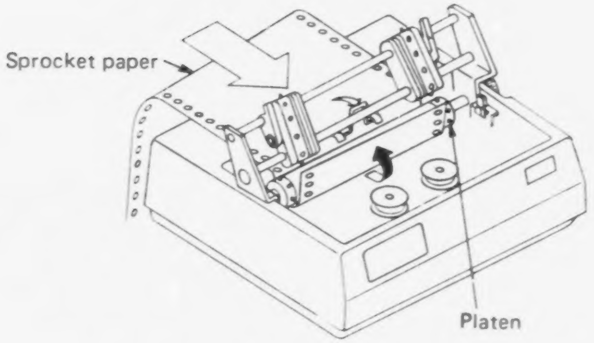
FIGURE 25


Sprocket cover (L)
Sprocket cover (R)

3. Insert paper until it reaches the front of the platen

    a. For rear paper feed, insert paper from the back of the platen (Figure 26)

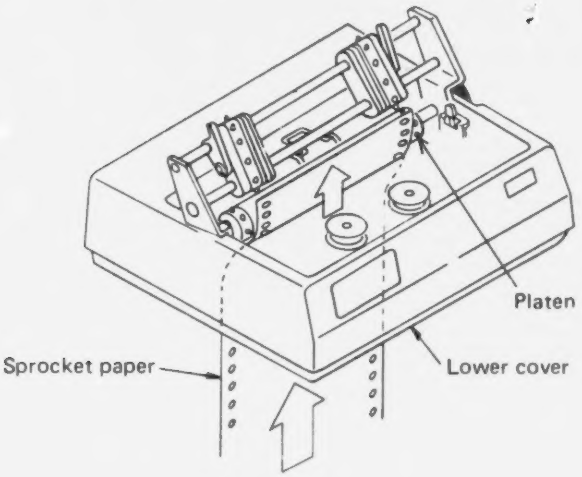
    FIGURE 26


Sprocket paper
Platen

JOB SHEET #3

b. For bottom paper feed, insert paper from printer lower case until it reaches the front of the platen (Figure 27)

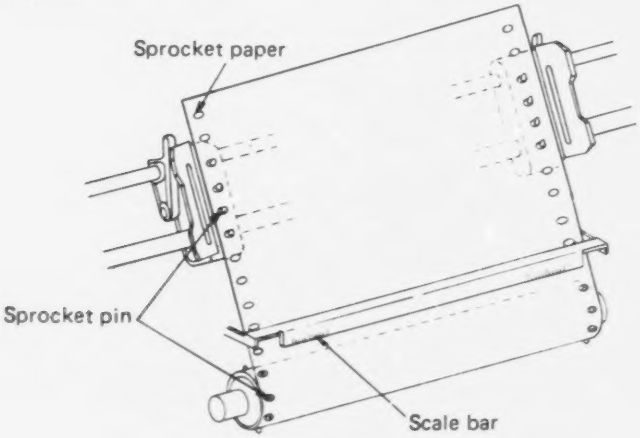
FIGURE 27


Platen
Sprocket paper
Lower cover

4. Guide the paper under the scale bar, and set the sprocket holes of the paper on the sprocket pins of both the platen and tractor units, then advance the paper with the platen knob

   a. For paper 9 ½" wide, both sides of the paper are placed over their respective sprocket pins (Figure 28)

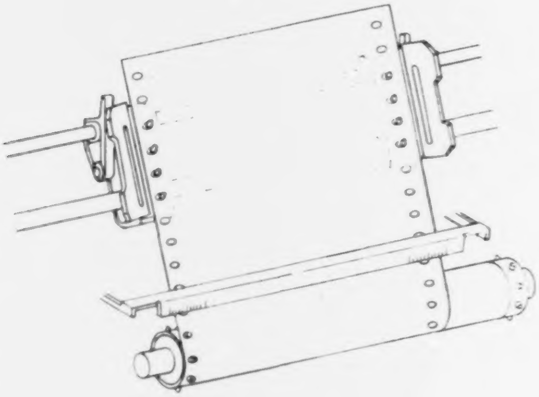
   FIGURE 28


Sprocket paper
Sprocket pin
Scale bar

JOB SHEET #3

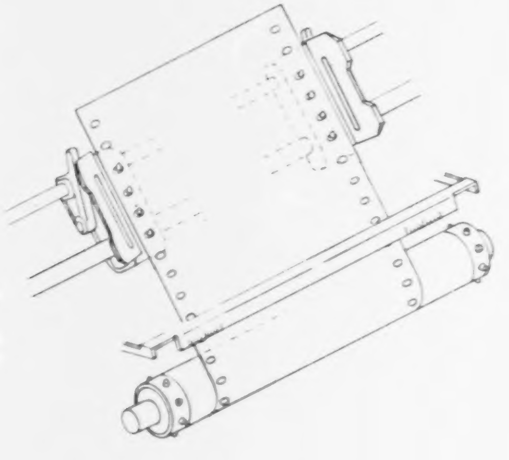
b. For paper 9″ or less wide, only the left hand side of the paper is engaged on the sprocket, and the tractor unit adjusted so that both sides of the paper are engaged in the tractor unit sprockets (Figure 29)

FIGURE 29



c. For paper 8 1/2″ or less wide, neither side of the paper is engaged on the sprocket, but the paper should be centered and the tractor unit adjusted so that both sides of the paper are engaged in the tractor unit sprockets (Figure 30)

FIGURE 30



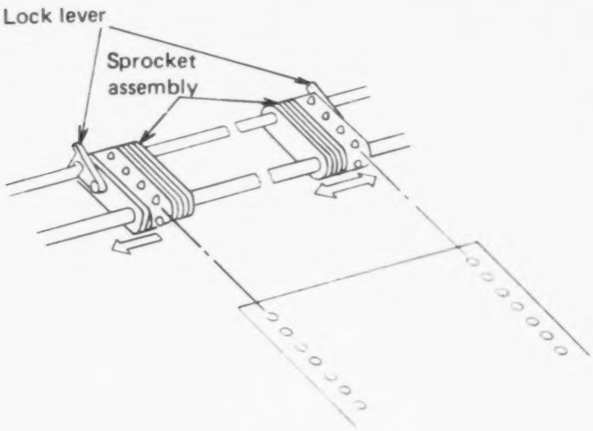
JOB SHEET #3

5. Use the following precautions for making paper width changes on the tractor unit:

   a. Unlock the left side lock lever first, slide the left sprocket assembly to the left end, and then lock it in place (Figure 31)

   b. Adjust the right sprocket assembly to the selected paper width, take up slack in the paper, then lock it in place (Figure 31)

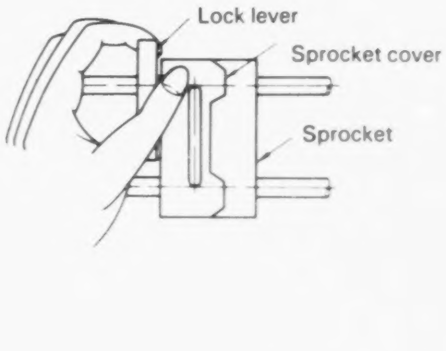
   FIGURE 31


Lock lever
Sprocket assembly

6. Use the following procedure for operating the sprocket lock levers

   a. To unlock the sprocket lock lever, put your thumb on the sprocket cover and pull the lock lever with your index finger (Figure 32)

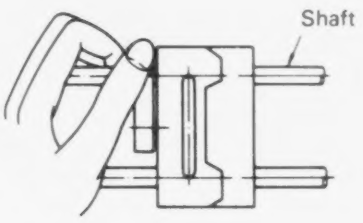
   FIGURE 32


Lock lever
Sprocket cover
Sprocket

JOB SHEET #3

b. To lock the sprocket lock lever, push the lock lever with your thumb while holding the shaft with your other fingers (Figure 33)

FIGURE 33



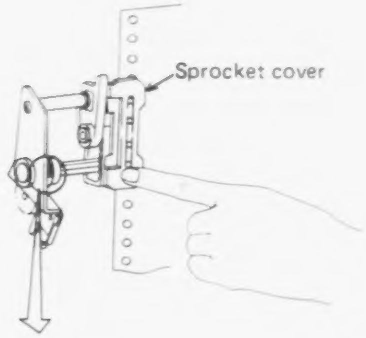
7. Close the sprocket covers left and right after paper width adjustments have been made on the tractor unit

   (NOTE: Simply reverse the procedure shown in Figure 25.)

8. Adjust any slack between the platen and tractor unit with the following procedure

   a. Slide the tractor gear to the left to disengage it from the idle gear (Figure 34)

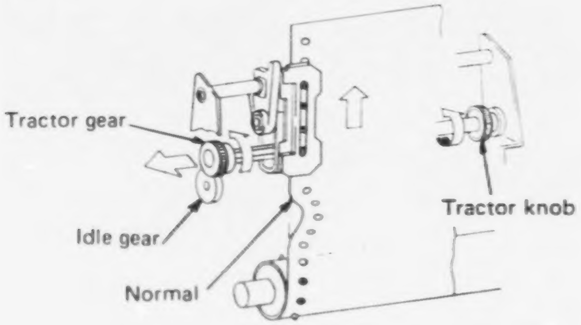
   FIGURE 34



JOB SHEET #3

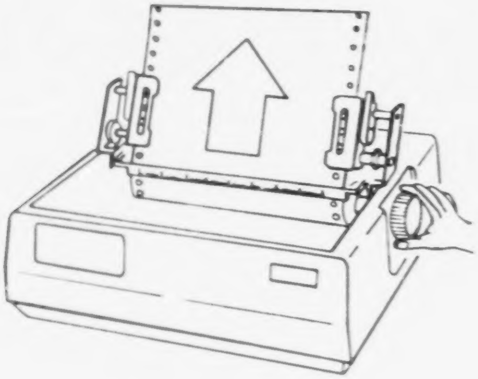
b. Turn the tractor knob forward to take up slack, and then slide the tractor gear back until it engages with the idle gear (Figure 35)

FIGURE 35



9. Close the scale bar and turn the platen knob to set the paper to top-of-form position, and pull the paper down or backward as needed to take up slack (Figure 36)

FIGURE 36



10. Have your instructor check your sprocket paper installation with a tractor unit

11. Replace the access cover

12. Sign off your troubleshooting log

13. Clean up area and return tools and equipment to proper storage or prepare for next job sheet as directed by your instructor

SERVICING AND REPAIRING DOT-MATRIX PRINTERS
UNIT II

JOB SHEET #4 — OPERATE AN ML92 PRINTER TO CHECK CONTROL FUNCTIONS AND RUN A PRINTER SELF TEST

A. Tools and equipment

1. Printer as selected by instructor
2. Maintenance manual
3. Screwdriver set
4. Roll or sprocket-fed paper as needed

B. Procedure for checking control functions

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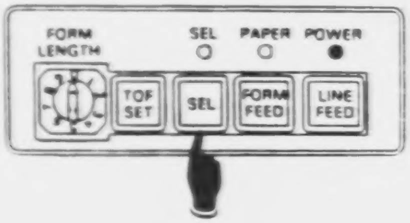
1. Sign on your troubleshooting log, and be sure to sign off the log at the end of this routine or at the appropriate time
2. Load printer with roll or sprocket-fed paper as outlined in previous job sheet
3. Turn the AC power switch ON
4. Check LINE FEED control
    a. Press the SEL switch to change the printer to offline state, and the SEL LED will go out (Figure 1)

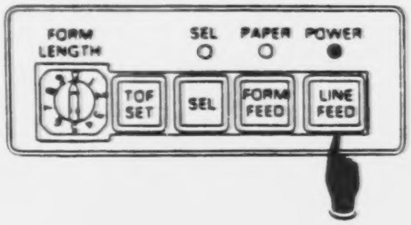
FIGURE 1



JOB SHEET #4

b. Press the LINE FEED switch a few times while checking to see that the paper feeds one line each time the switch is pressed (Figure 2)

FIGURE 2


FORM LENGTH
SEL
PAPER
POWER
TOF SET
SEL
FORM FEED
LINE FEED

5. Use the AC power switch to check FORM LENGTH SETTING

a. Turn the AC power switch OFF

b. Check FORM LENGTH and rotary switch settings according to the following table (Figure 3)

FIGURE 3

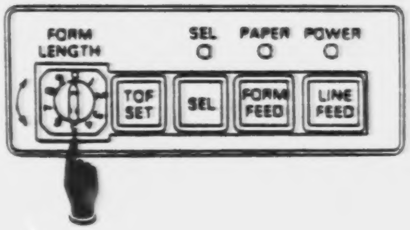
FORM LENGTH Rotary Switch

Switch position	FORM LENGTH	6 LPI	8 LPI
0	3 inches	18 lines	24 lines
1	3.5 inches	21 lines	28 lines
2	4 inches	24 lines	32 lines
3	5.5 inches	33 lines	44 lines
4	6 inches	36 lines	48 lines
5	7 inches	42 lines	56 lines
6	8 or 8.5 inches*	48 or 51 lines*	64 or 68 lines*
7	11 inches	66 lines	88 lines
8	12 inches	72 lines	96 lines
9	14 inches	84 lines	112 lines

*Selectable by DIP switch

c. Set the FORM LENGTH rotary switch to the desired position (Figure 4)

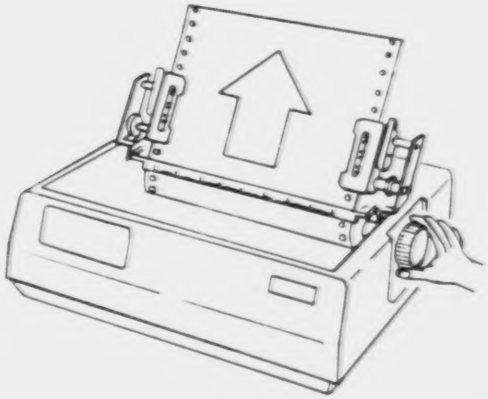
FIGURE 4


FORM LENGTH
SEL
PAPER
POWER
TOF SET
SEL
FORM FEED
LINE FEED

JOB SHEET #4

6. Turn the AC power switch ON and check to see that both the SEL and POWER LEDs light up, then turn the platen knob to set the paper to top-of-form position and the form length will be set (Figure 5)

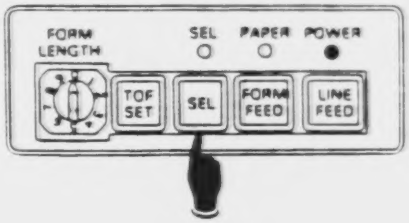
FIGURE 5



7. Use the TOF SET switch to check FORM LENGTH SETTING

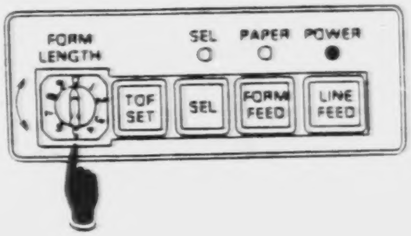
   a. Press the SEL switch to put the printer in an offline state, and the SEL LED should go out (Figure 6)

   FIGURE 6


FORM LENGTH
SEL
PAPER
POWER
TOF SET
SEL
FORM FEED
LINE FEED

   b. Set the FORM LENGTH rotary switch to desired position as indicated by the table in Figure 3 (Figure 7)

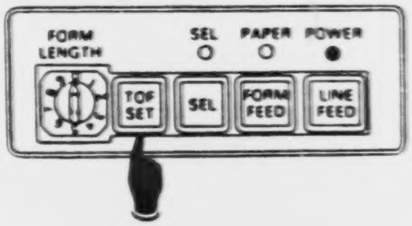
   FIGURE 7


FORM LENGTH
SEL
PAPER
POWER
TOF SET
SEL
FORM FEED
LINE FEED

JOB SHEET #4

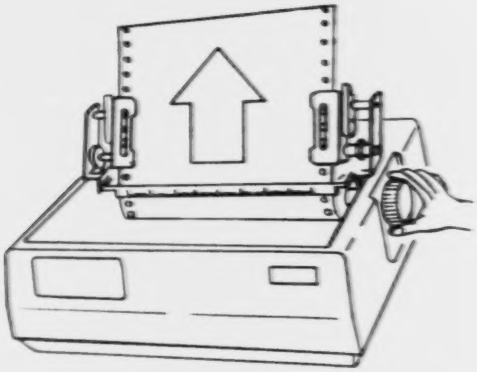
c. Press the TOF SET switch (Figure 8)

FIGURE 8


FORM LENGTH
SEL
PAPER
POWER
TOF SET
SEL
FORM FEED
LINE FEED

d. Turn the platen knob to set the paper to the top-of-form position and the form length will be set (Figure 9)

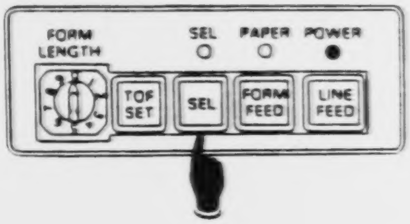
FIGURE 9



8. Check FORM FEED control

   a. Press the SEL switch to set the printer in an offline state and the SEL LED should go out (Figure 10)

FIGURE 10

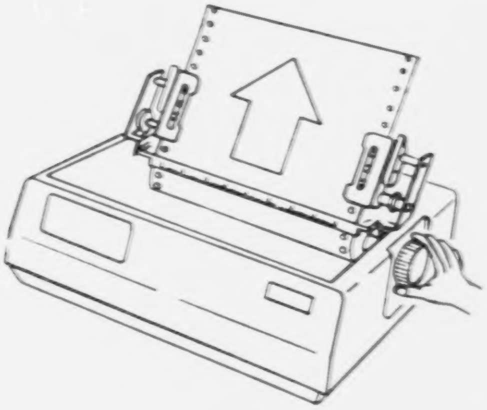

FORM LENGTH
SEL
PAPER
POWER
TOF SET
SEL
FORM FEED
LINE FEED

JOB SHEET #4

b. Set the form length, if necessary, as previously outlined

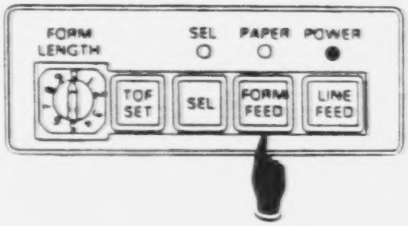
c. Turn the platen knob to set the paper to the top-of-form position, but do not use the LINE FEED switch (Figure 11)

FIGURE 11



d. Press the FORM FEED switch, and this should feed the paper to the next top-of-form position (Figure 12)

FIGURE 12


FORM LENGTH
SEL
PAPER
POWER
TOF SET
SEL
FORM FEED
LINE FEED

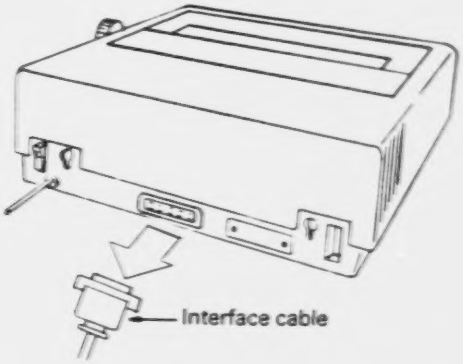
JOB SHEET #4

9. Run a printer self test with the following procedure

   a. Turn the AC power switch OFF

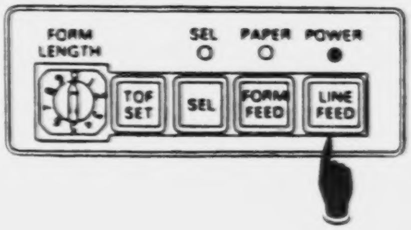
   b. Remove the interface cable from the printer (Figure 13)

   FIGURE 13


Interface cable

   c. Hold the LINE FEED switch down while you turn the AC power switch ON, and release the LINE FEED switch about two seconds after turning the power on (Figure 14)

   FIGURE 14


FORM LENGTH
SEL
PAPER
POWER
TOF SET
SEL
FORM FEED
LINE FEED

JOB SHEET #4

d. Check to see that the printer reproduces a rolling ASCII pattern in one sequence only (Figure 15)

FIGURE 15

Rolling ASCII pattern

```
REVISION NO. = 1.4 1.2
 !"#$%&'()*+,-./0123456789:
!"#$%&'()*+,-./0123456789:;
"#$%&'()*+,-./0123456789:;<
#$%&'()*+,-./0123456789:;<=
$%&'()*+,-./0123456789:;<=>
%&'()*+,-./0123456789:;<=>?
&'()*+,-./0123456789:;<=>?@
'()*+,-./0123456789:;<=>?@A
()*+,-./0123456789:;<=>?@AB
)*+,-./0123456789:;<=>?@ABC
*+,-./0123456789:;<=>?@ABCD
+,-./0123456789:;<=>?@ABCDE
,-./0123456789:;<=>?@ABCDEF
-./0123456789:;<=>?@ABCDEFG
./0123456789:;<=>?@ABCDEFGH
/0123456789:;<=>?@ABCDEFGHI
```

10. Press the SEL switch to return the printer to an online state

11. Plug the interface cable back into the printer

12. Sign off your troubleshooting log

13. Have your instructor check your work, including the printer self test

    (NOTE: Checking control functions and running a printer self test should be used to conclude all service and repair activity, and when major parts have been replaced, the printer should be run for at least a one-hour burn-in period.)

14. Clean up area and return tools and equipment to proper storage, or prepare for next job sheet as directed by your instructor

SERVICING AND REPAIRING DOT-MATRIX PRINTERS
UNIT II

JOB SHEET #5 — MAKE TENSION AND GAP ADJUSTMENTS ON AN ML92 DOT-MATRIX PRINTER

A. Tools and equipment

1. Microline printer as selected by instructor
2. Microline maintenance manual
3. Phillips screwdriver
4. 5.5 mm and 11 mm wrenches
5. Thickness gauge
6. Bar tension gauge
7. Vacuum cleaner, brush, and cleaning cloth

B. Procedure

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1. Sign on your troubleshooting log, and be sure to sign off the log at the appropriate time
2. Unplug printer from AC power source and turn the printer AC power switch OFF
3. Remove printer upper case as outlined in a previous job sheet

   (NOTE: One of the prime rules for good printer repair is to disassemble no more of the printer than is required to complete an adjustment or make a repair, so throughout the remainder of this job sheet you will have to make decisions about further disassembly, so read all parts of the job sheet carefully and base your disassembly on specific need.)

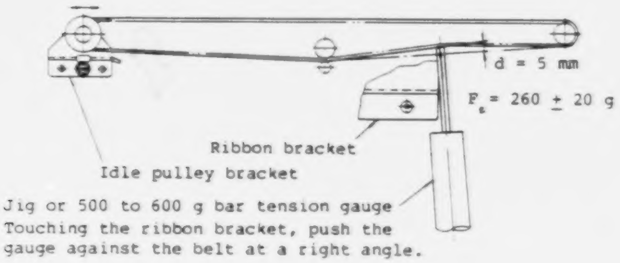
JOB SHEET #5

C. Procedure for checking tension of space belt (Figure 1)

1. Place carriage in home position and turn AC power switch OFF
2. Slide the end of the tension gauge along the ribbon bracket so that it touches the belt at a right angle
3. Depress the belt with the gauge until the distance (d) between the two sides of the belt is at 5 mm
4. Check the gauge for a force (F) of 260 g (plus or minus 20 g)
5. If the reading is improper, loosen and adjust the position of the idle pulley bracket to get the right amount of tension

☐ Have your instructor check your work

FIGURE 1


d = 5 mm
F_s = 260 ± 20 g
Ribbon bracket
Idle pulley bracket
Jig or 500 to 600 g bar tension gauge
Touching the ribbon bracket, push the gauge against the belt at a right angle.

D. Procedure for checking position of the belt clamp (Figure 2)

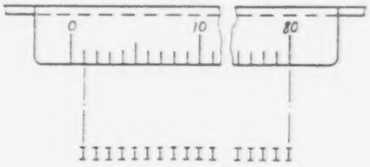
1. Power may be ON or carriage may be returned manually
2. Verify that the position of the belt clamp is within the standard value of 2 mm (plus or minus 0.5 mm) when it is mounted with the upper side touched

JOB SHEET #5

3. If the value is other than standard, readjust the position of the belt clamp until a thickness gauge indicates a proper value

   ☐ Have your instructor check your work

   FIGURE 2



E. Procedure for checking printing position (Figure 3)

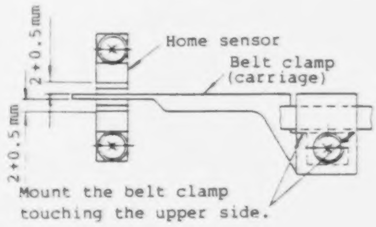
1. Run a printer self test and check the top line of print against the number scale marks on the scale bar

2. Verify that all characters align on center with their appropriate number scale marks and that the variance is no more than plus or minus 0.5 mm

3. If the letters are not in standard alignment, readjust the position of the home sensor and space motor

   ☐ Have your instructor check your work

   FIGURE 3


2+0.5mm
Home sensor
Belt clamp
(carriage)
2+0.5mm
Mount the belt clamp
touching the upper side.

JOB SHEET #5

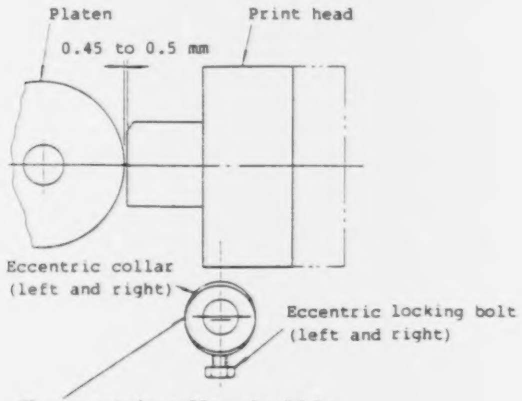
F. Procedure for checking gap between platen and printhead (Figure 4)

1. Use the thickness gauge to determine whether the platen to printhead clearance at each end of the platen is within the standard of 0.45 to 0.5 mm
2. If adjustment is required, put the head-gap lever adjustment in position 1

   (NOTE: If the platen shakes and interferes with adjustment, set the paper-clamp lever to the C or closed position and continue.)
3. Loosen the eccentric locking bolts on each end of the upper carriage shaft, make sure the bolts are centered on the lower side, then use the thickness gauge to set the gap while moving the eccentric collars slightly in whatever direction is required for the adjustment
4. Tighten the eccentric bolts on both ends of of the upper carriage shaft and make a final check of the gap at both ends of the platen

☐ Have your instructor check your work

FIGURE 4


Platen
Print head
0.45 to 0.5 mm
Eccentric collar (left and right)
Eccentric locking bolt (left and right)

The eccentric collar should be positioned so that the eccentric locking bolt is on the lower side.

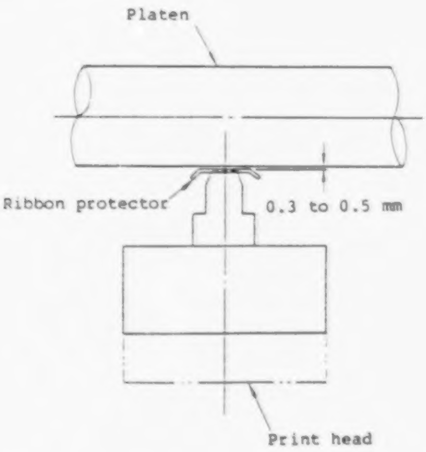
JOB SHEET #5

G. Procedure for checking gap between platen and ribbon protector (Figure 5)

1. Use a thickness gauge to see if the gap is within the standard of 0.3 to 0.5 mm
2. Make adjustment as needed

☐ Have your instructor check your work

FIGURE 5

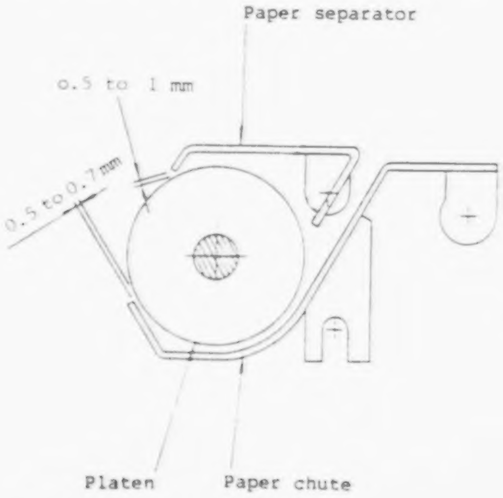

Platen
Ribbon protector
0.3 to 0.5 mm
Print head

H. Procedure for checking gap between platen and paper chute and platen and paper separator (Figure 6)

1. Check for a platen-paper chute gap of 0.5 to 0.7 mm, and platen-paper separator gap of 0.5 to 1 mm
2. Loosen, adjust, and retighten the paper chute and paper separator adjustments as required

☐ Have your instructor check your work

FIGURE 6


Paper separator
0.5 to 1 mm
0.5 to 0.7 mm
Platen
Paper chute

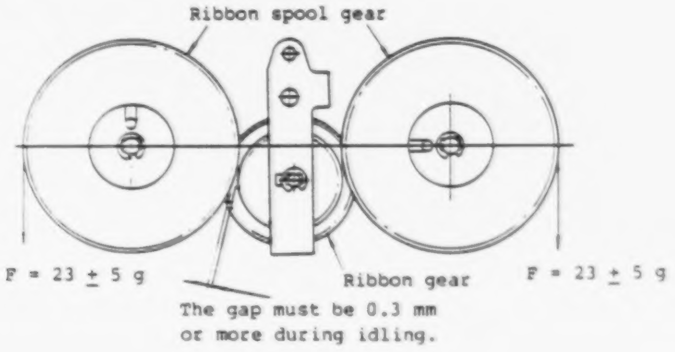
JOB SHEET #5

I. Procedure for checking gap between ribbon spool gear and ribbon gear, and for checking gap between ribbon change lever and snap shaft (Figure 7)

1. Activate the printer as required so ribbon gear will idle, then use the thickness gauge to check the ribbon spool gear to ribbon gear gap to make sure it is at least 0.3 mm or slightly more
2. Activate the printer as required so the ribbon will feed, then use the thickness gauge to check the ribbon change lever to snap shaft gap to make sure it is at least 0.2 mm or slightly more
3. Make adjustments as required

☐ Have your instructor check your work

FIGURE 7

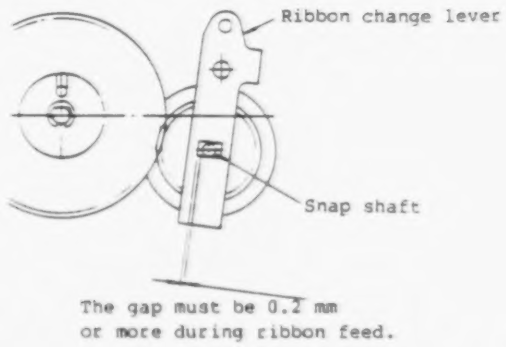

Ribbon spool gear
F = 23 ± 5 g
Ribbon gear
F = 23 ± 5 g
The gap must be 0.3 mm
or more during idling.

J. Procedure for checking friction tension of the ribbon spool gear (Figure 8)

1. Activate printer so that ribbon gear is idling, then use the thickness gauge to check for a gap of 0.3 mm or slightly more between each of the ribbon spool gears and the ribbon gear
2. Use a 50g tension gauge to check illustrated points on the ribbon spools for a tension force (F) of 23g (plus or minus 5g), and make adjustments as required

☐ Have your instructor check your work

FIGURE 8


Ribbon change lever
Snap shaft
The gap must be 0.2 mm
or more during ribbon feed.

JOB SHEET #5

K. Sign off your troubleshooting log

L. Clean up area and return tools and equipment to proper storage, or prepare for next job sheet as directed by your instructor

SERVICING AND REPAIRING DOT-MATRIX PRINTERS
UNIT II

JOB SHEET #6 — REMOVE AND REPLACE MAJOR COMPONENTS OF AN ML92 PRINTER

A. Tools and equipment

1. Printer as selected by instructor
2. Maintenance manual for instructor
3. Hand tools
4. Troubleshooting log (from previous job sheet)

B. Procedure

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1. Sign on your troubleshooting log, and be sure to sign off at the appropriate time
2. Remove the upper case as outlined in a previous job sheet

   (NOTE: The illustrations for the following procedures are in order following this job sheet so they can be used as may be required for later troubleshooting activity, so refer to them as required in this job sheet, and use them as necessary to make future job sheets easier to accomplish.)

C. Procedure for removing and replacing the MLPC circuit board (Figure 1)

1. Remove all connectors that can be removed from the MLPC circuit board at this time
2. Remove the MLPC circuit board mounting screws and be sure to save them
3. Slide the board up a little and remove the rest of the connectors from the board
4. Remove the board for required troubleshooting

JOB SHEET #6

5. Replace the MLPC board by reversing the removal procedure

   (NOTE: When replacing ROMs on the MLPC board, make sure you have the proper ROM identification number.)

   ☐ Have your instructor check your work

D. Procedure for removing and replacing the printer unit (Figure 2)

1. Remove the upper case and MLPC circuit board as previously outlined

2. Remove all cables of the printer unit from the cord clamp (see Figure 4 for this one item)

3. Loosen the quite-tight mounting screws until the quite-tight swelling is removed

   (NOTE: It's a good idea to measure how far the top of the quite-tight screws come out above the quite-tight swelling so that when the screws are replaced, it will eliminate guessing as to how much they should be tightened.)

4. Pull up the printer unit and perform troubleshooting as required

5. Replace the printer unit by reversing the removal procedure, but be sure the cables are reseated in their proper places (Figure 3)

6. Tighten the quite-tight mounting screws until the screws come out about 1 to 1.5 mm above the quite-tight swelling (refer to the note below item D3.)

   ☐ Have your instructor check your work

E. Procedure for removing and replacing the power supply assembly (Figure 4)

1. Remove the upper case and the MLPC circuit board as previously outlined

2. Remove the LEPM circuit board mounting screws

3. Remove the cord bushing from the lower unit

4. Remove the transformer cables from the cord clamp

5. Reverse the removal procedure to replace the LEPM circuit board, but make sure all cables go back in their proper places, so refer to both Figure 3 and Figure 4 as required

   ☐ Have your instructor check your work

JOB SHEET #6

F. Procedure for removing and replacing the printhead (Figure 5)

1. Remove the access cover

   (NOTE: Replacing a printhead does not require removing the upper case or any other component disassembly.)

2. Remove the printhead cable plug from its receptacle

   (NOTE: The cable plug should have a gray ground wire.)

3. Hold the carriage frame with one hand, then pull the printhead up and out with the other hand

4. Replace the printhead by reversing the removal procedure, but when putting the printhead cable back in its receptacle, twist it clockwise one full turn

   ☐ Have your instructor check your work

G. Procedure for removing and replacing the carriage frame (Figure 6)

1. Remove the upper case and the printhead as previously outlined

2. Remove the belt clamp by unscrewing its mounting screw

   (NOTE: Keep track of the screws as they are removed, and it's not a bad idea to put them temporarily back where they come from until time to put the carriage frame back together.)

3. Loosen the eccentric locking bolts on both sides of the upper carriage shaft and remove the eccentric collars

4. Remove the upper carriage shaft from the left and right side frames

5. Remove the printhead cable receptacle from the carriage frame by unscrewing its mounting screw

6. Lift up on the carriage frame to remove it from the lower carriage shaft

7. Replace the carriage frame by reversing the removal procedure

   (NOTE: This procedure is required when adjusting the gap between the platen and the printhead or when adjusting the position of the belt clamp.)

   ☐ Have your instructor check your work

JOB SHEET #6

H. Procedure for removing and replacing the space motor (Figure 7)

1. Remove the upper case and MLPC circuit board
2. Remove the space motor cable from the cord clamps
3. Cut the tie-wrap fastening the space motor cable
4. Remove the cable guide by pulling it sideways
5. Remove the space belt from the space motor pulley
6. Remove the space motor by unscrewing it from its mounting screws, and be sure to save the screws or temporarily putting them back in place
7. Replace the space motor by reversing the removal procedure

   (NOTE: This procedure is required to adjust the tension on the space belt.)

   ☐ Have your instructor check your work

I. Procedure for removing and replacing the space belt (Figure 8)

1. Remove the upper case as previously outlined
2. Loosen the idle pulley bracket mounting screw, then slide the bracket to the right to give some slack to the space belt
3. Remove the belt clamp by unscrewing its mounting screw, then put the screw temporarily back in place
4. Remove the E-snap ring of one ribbon spool gear, then remove the ribbon spool gear, and be sure to hang onto the plastic washer
5. Remove the detent spring
6. Remove the E-snap ring, ribbon change, lever, and ribbon drive gear
7. Remove the space belt (adjust the belt at this time)
8. Replace the space belt by reversing the removal procedure, but be sure when reassembling the ribbon drive gear that the ribbon drive gear pulley and the space belt engage properly
9. Check to make sure the E-snap ring does not turn as the ribbon is feeding

   (NOTE: E-snap rings should never be reused, but if you are stuck on a service call without a new one, use a pair of pliers to narrow the gap on the old snap ring before putting it back.)

   ☐ Have your instructor check your work

JOB SHEET #6

J. Procedure for removing and replacing the platen (Figure 9)

1. Remove the upper case as previously outlined
2. Lift the scale bar
3. Remove the paper separator by unscrewing its mounting screws, and put the screws temporarily back in place
4. Remove the E-snap ring, wave-washer, and platen bearing from the right side of the washer and remember how they should go back in place
5. Pull the platen bearing sideways until its head comes out from the side plate, then turn the platen 90° and pull it up

   (NOTE: The paper separator and the platen can be adjusted at this point.)

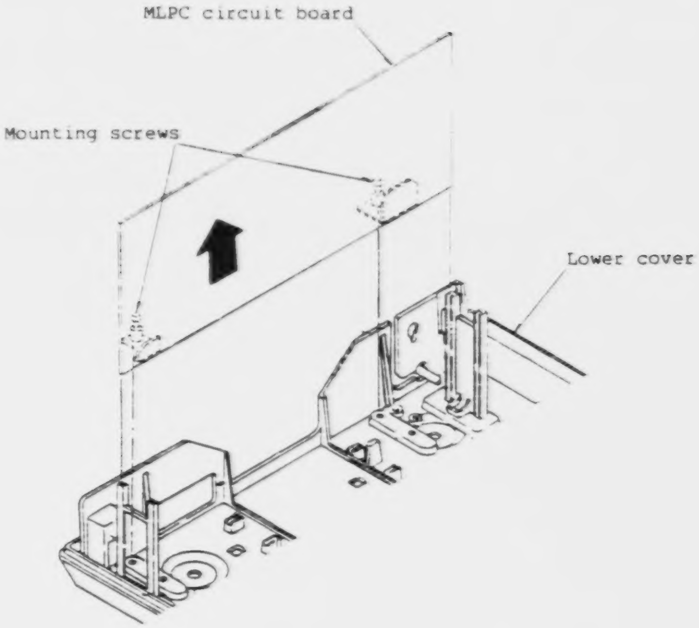
6. Replace the platen by reversing the removal procedure, and use a new E-snap ring

   ☐ Have your instructor check your work

7. Sign off your troubleshooting log
8. Clean up area and return tools and equipment to proper storage, or prepare for next job sheet as directed by your instructor

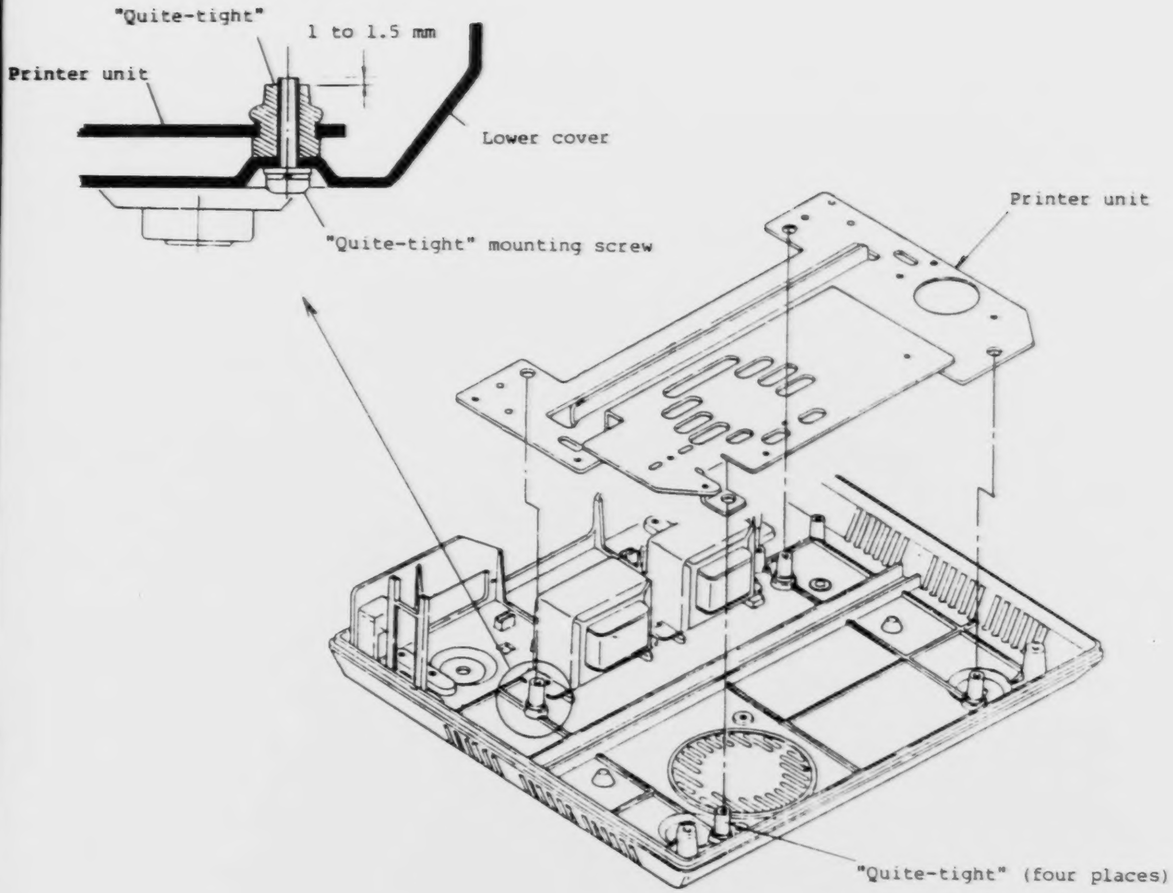
JOB SHEET #6

FIGURE 1


MLPC circuit board
Mounting screws
Lower cover

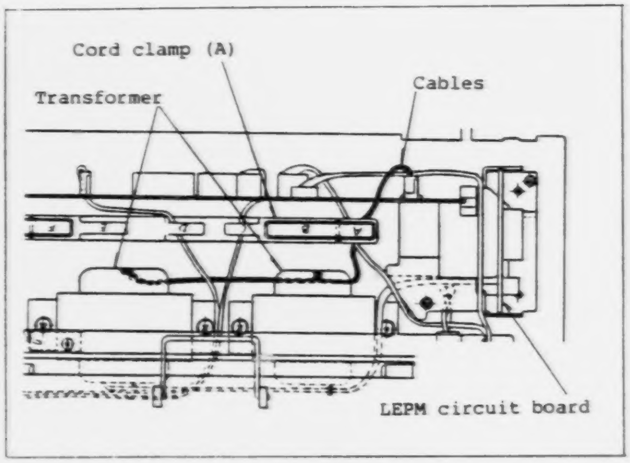
JOB SHEET #6

FIGURE 2


"Quite-tight"
1 to 1.5 mm
Printer unit
Lower cover
"Quite-tight" mounting screw
Printer unit
"Quite-tight" (four places)

JOB SHEET #6

FIGURE 3


Cord clamp (A)
Transformer
Cables
LEPM circuit board

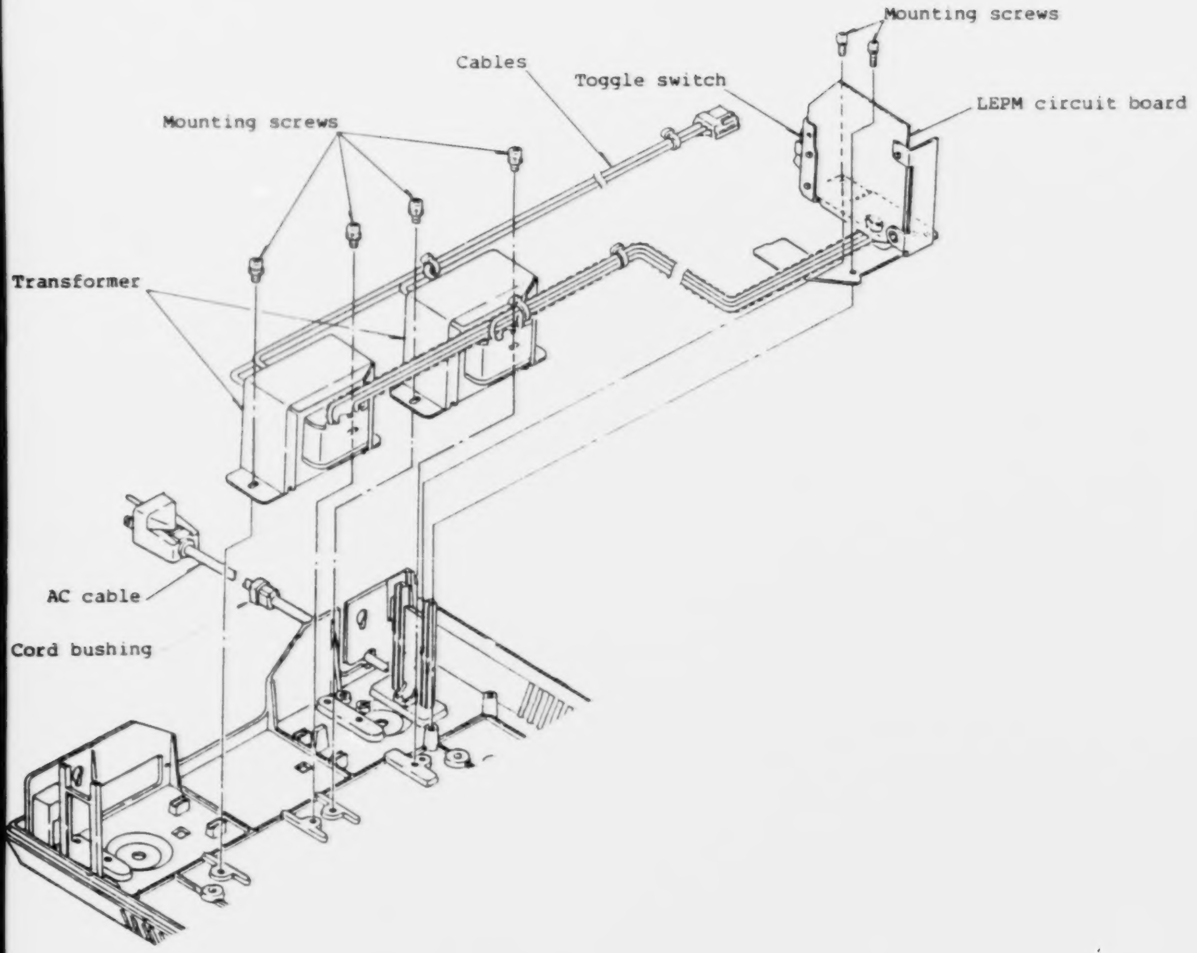
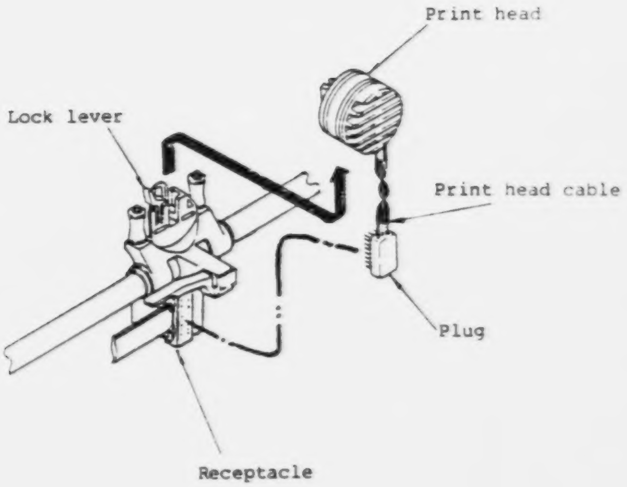

Mounting screws
Cables
Toggle switch
LEPM circuit board
Mounting screws
Transformer
AC cable
Cord bushing

FIGURE 4

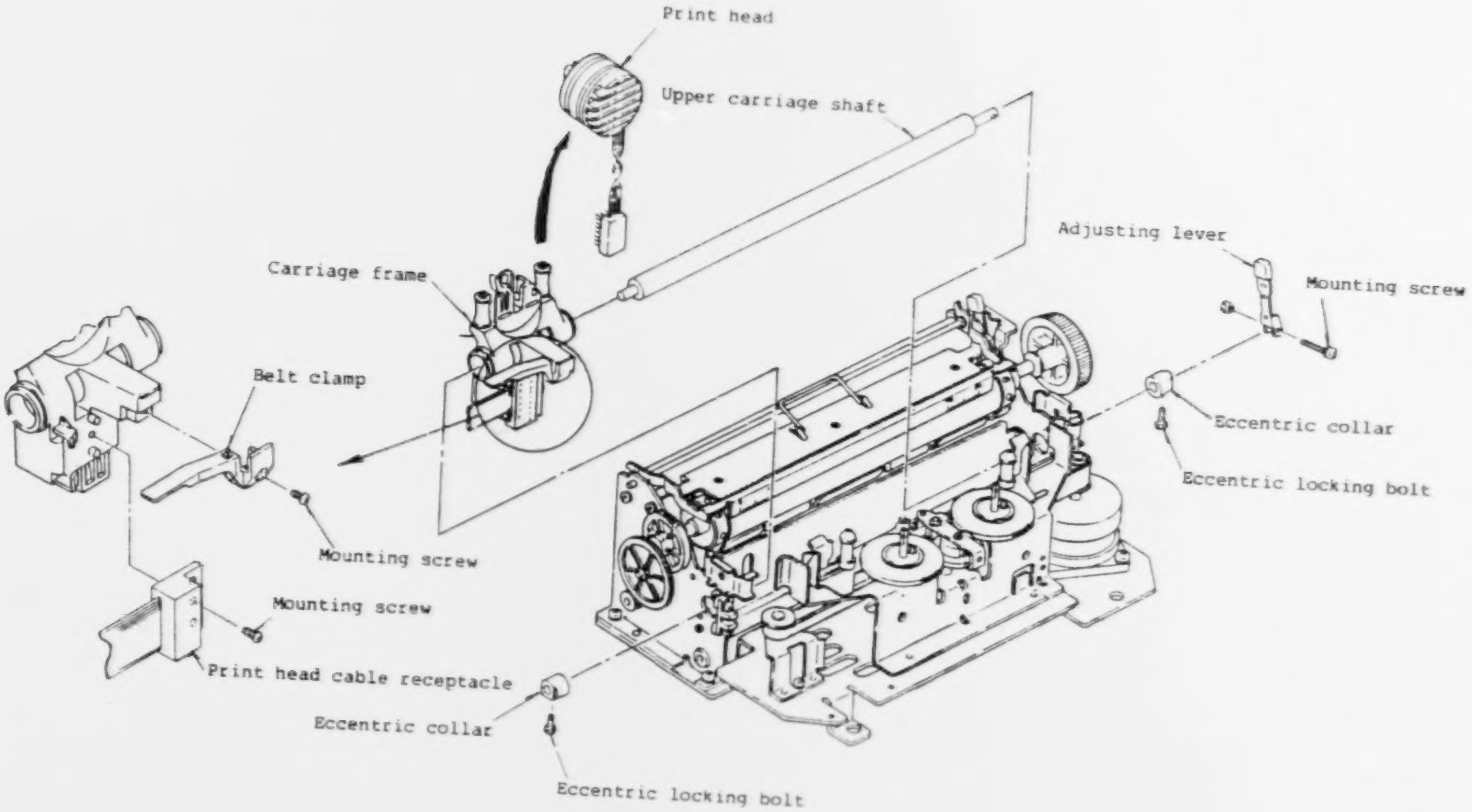
JOB SHEET #6

FIGURE 5


Print head
Lock lever
Print head cable
Plug
Receptacle

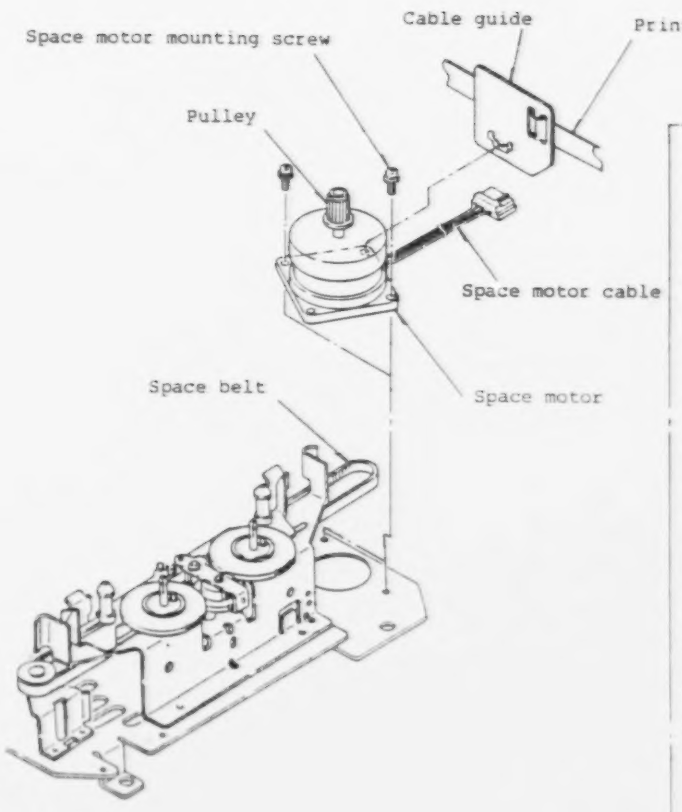
JOB SHEET #6

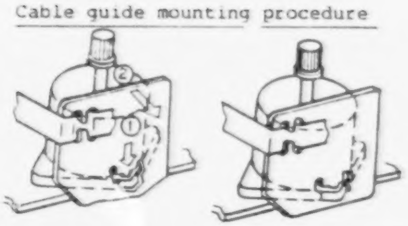
FIGURE 6

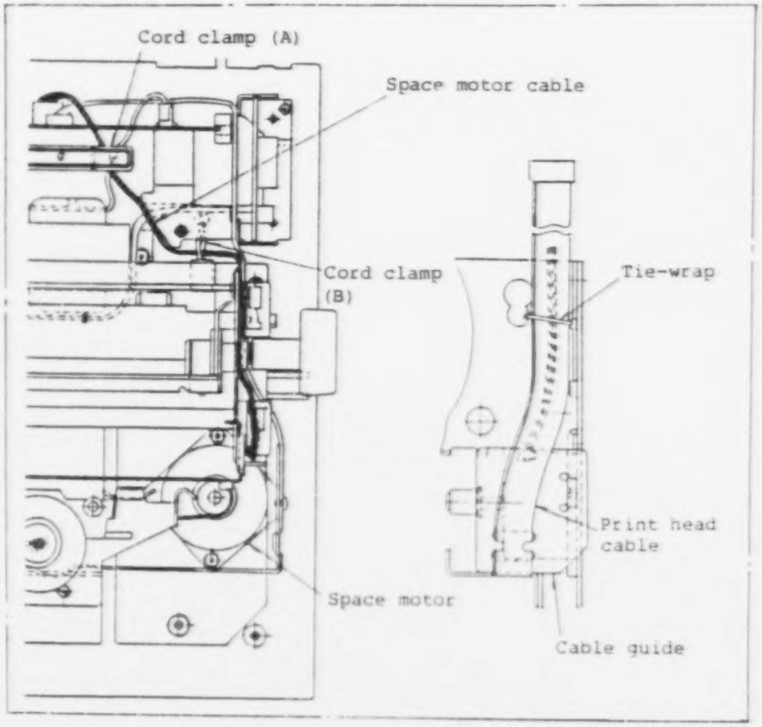

Print head
Upper carriage shaft
Adjusting lever
Mounting screw
Carriage frame
Belt clamp
Eccentric collar
Eccentric locking bolt
Mounting screw
Mounting screw
Print head cable receptacle
Eccentric collar
Eccentric locking bolt

JOB SHEET #6

FIGURE 7


Space motor mounting screw
Cable guide
Print head cable
Pulley
Space motor cable
Space motor
Space belt


Cable guide mounting procedure
①
②


Cord clamp (A)
Space motor cable
Cord clamp (B)
Tie-wrap
Print head cable
Space motor
Cable guide

JOB SHEET #6

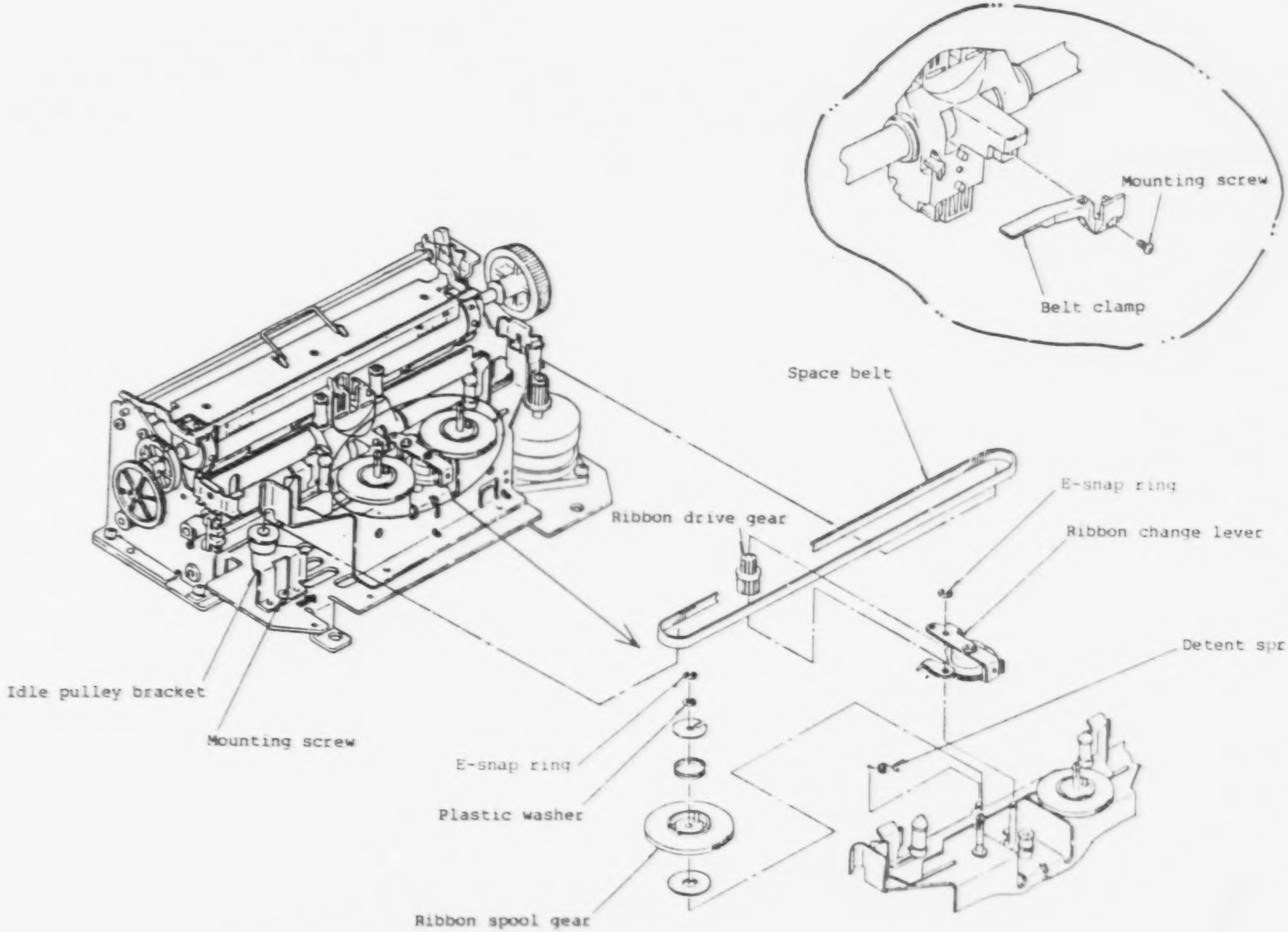
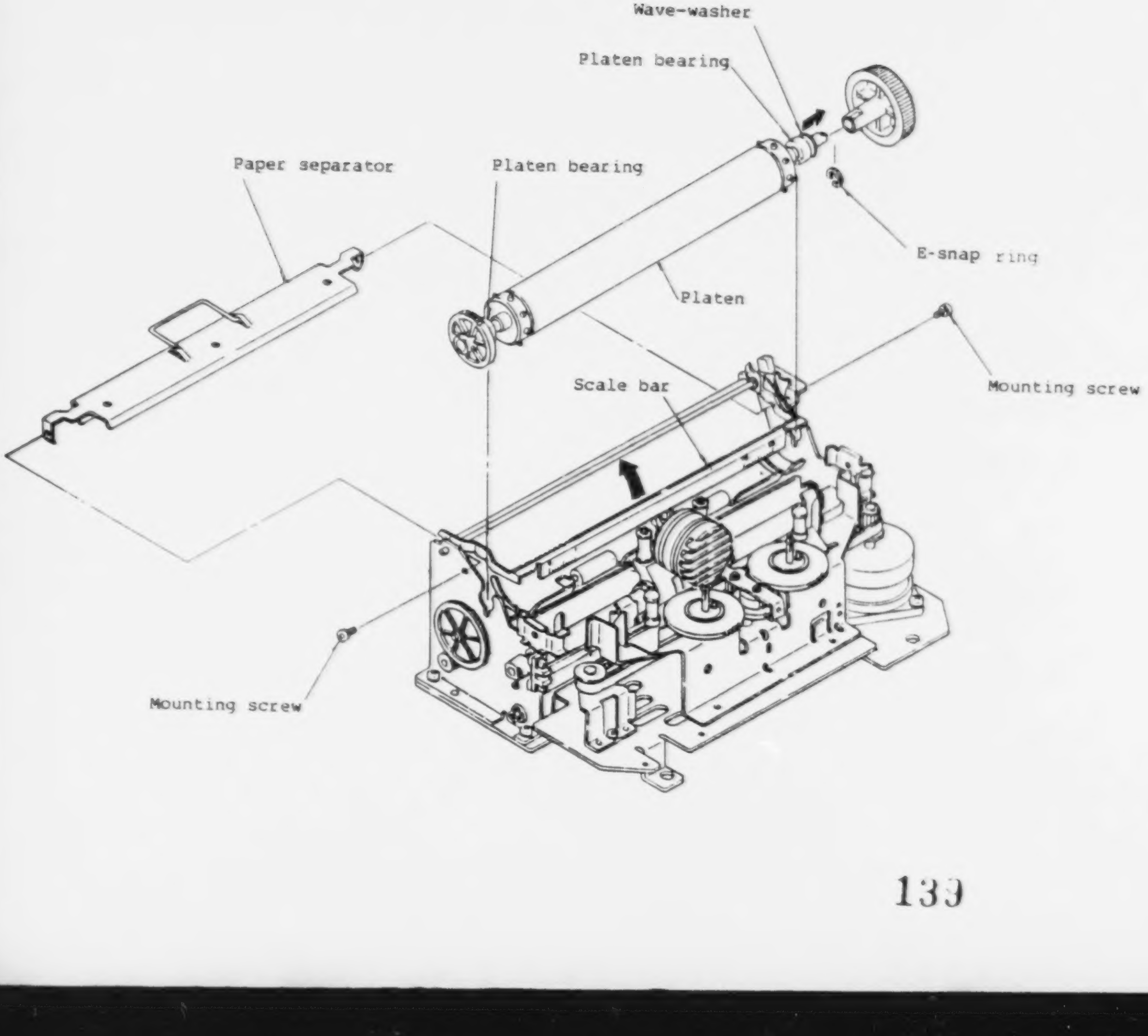

Mounting screw
Belt clamp
Space belt
E-snap ring
Ribbon change lever
Ribbon drive gear
Detent spring
Idle pulley bracket
Mounting screw
E-snap ring
Plastic washer
Ribbon spool gear

FIGURE 8

FIGURE 9


Wave-washer
Platen bearing
Paper separator
Platen bearing
E-snap ring
Platen
Mounting screw
Scale bar
Mounting screw

SERVICING AND REPAIRING DOT-MATRIX PRINTERS
UNIT II

JOB SHEET #7 — TROUBLESHOOT AN ML92 PRINTER WHEN THE PRINTHEAD DOES NOT MOVE AT POWER-UP

A. Tools and equipment

1. Printer as selected by instructor
2. Maintenance manual for printer
3. Hand tools
4. DVOM
5. Dual-phase oscilloscope
6. Troubleshooting log (from previous job sheet)
7. Replacement parts as required

B. Procedure

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1. Sign on your troubleshooting log, and refer to the schematics in Figures 1 and 2 as needed

   (NOTE: Be sure to save Figures 1 and 2 because you will need to refer to those fold-out schematics for many of the following job sheets.)

2. Disassemble the printer as required for each of the following troubleshooting activities

3. Check to see if the POWER LED lights up

   a. If it does, move on to next checkpoint

   b. If it doesn't, check the circuit breaker on the power supply board and close it

JOB SHEET #7

   c. If that isn't the problem, check the F1 fuse on the MLPC circuit board and replace the fuse, if needed

   d. If that isn't the problem, check the seating of connectors CN1 and CN5, and replace the LEPM circuit board if required

4. Check to see if the printhead carriage locks

   a. If it does, move on to the next checkpoint

   b. If it doesn't, check the +35V line voltage, and then check to see if the space motor driver is faulty, and replace the MLPC circuit board if needed

   c. If that isn't the problem, check the seating of CN4 and insert it again properly

5. Check to see if the microprocessors operate

   a. If they do, move on to the next checkpoint

   b. If they don't, check the oscillation of the crystal and replace Q1 (8051) Q2 (8741), and Q3 (8155H-2) if they are faulty

   c. If that isn't the problem, replace the MLPC circuit board

6. Check to see if the RESET remains on

   a. If it does, Q19 is faulty, so replace the MLPC circuit board

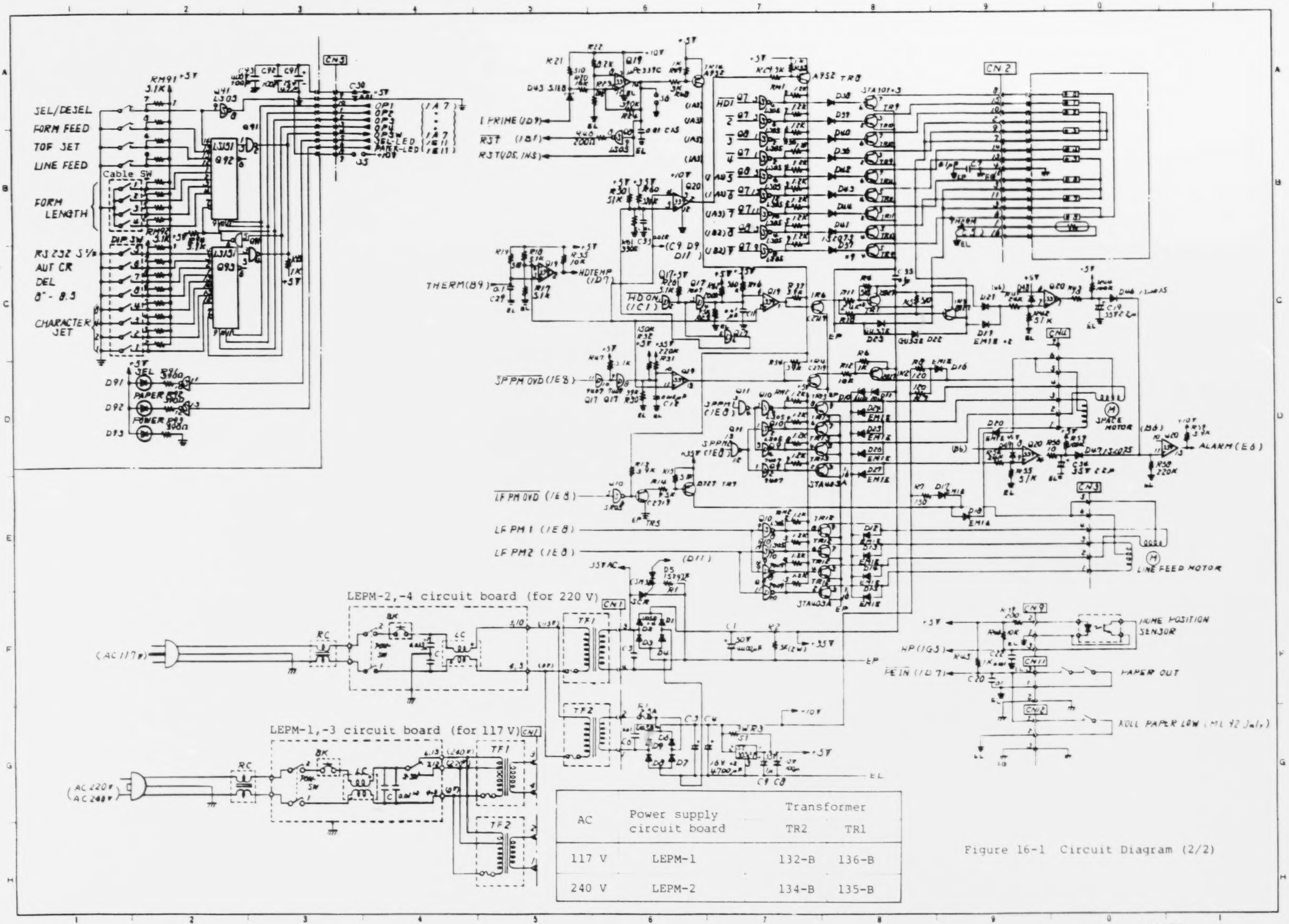
   b. Reassemble printer, turn power ON, and run a printer self test

7. Have your instructor check your work

8. Sign off your troubleshooting log

9. Clean up area and return tools and equipment to proper storage, or prepare for next job sheet as directed by your instructor

JOB SHEET #7


SEL/DESEL
FORM FEED
TOF SET
LINE FEED
Cable SW
FORM LENGTH
DIP SW
RS232 S1/8
AUT CR
DEL
8" - 8.5
CHARACTER SET
SEL
PAPER
POWER
D91
D92
D93
CN3
OP1
OP2
OP3
OP4
SPSW
SEL-LED
PAPER-LED
+5V
+10V
I PRIME (ID9)
RST (IB1)
RST(DS.INS)
THERM(B9)
HDTEMP (ID7)
HDON (IC1)
SPPM OVD (IE8)
LF PM OVD (IE8)
LF PM1 (IE8)
LF PM2 (IE8)
CN2
CN4
SPACE MOTOR
ALARM (E6)
CN5
LINE FEED MOTOR
LEPM-2,-4 circuit board (for 220 V)
LEPM-1,-3 circuit board (for 117 V)
(AC117V)
AC220V
AC240V
RC
BK
LC
TF1
TF2
CN1
-35V
EP
EL
HOME POSITION SENSOR
HP (IG5)
PE IN (ID7)
PAPER OUT
ROLL PAPER LOW (ML 92 Only)
CN9
CN11
CN12

AC	Power supply circuit board	Transformer TR2	Transformer TR1
117 V	LEPM-1	132-B	136-B
240 V	LEPM-2	134-B	135-B

Figure 16-1 Circuit Diagram (2/2)

FIGURE 1

BEST COPY AVAILABLE

JOB SHEET #7

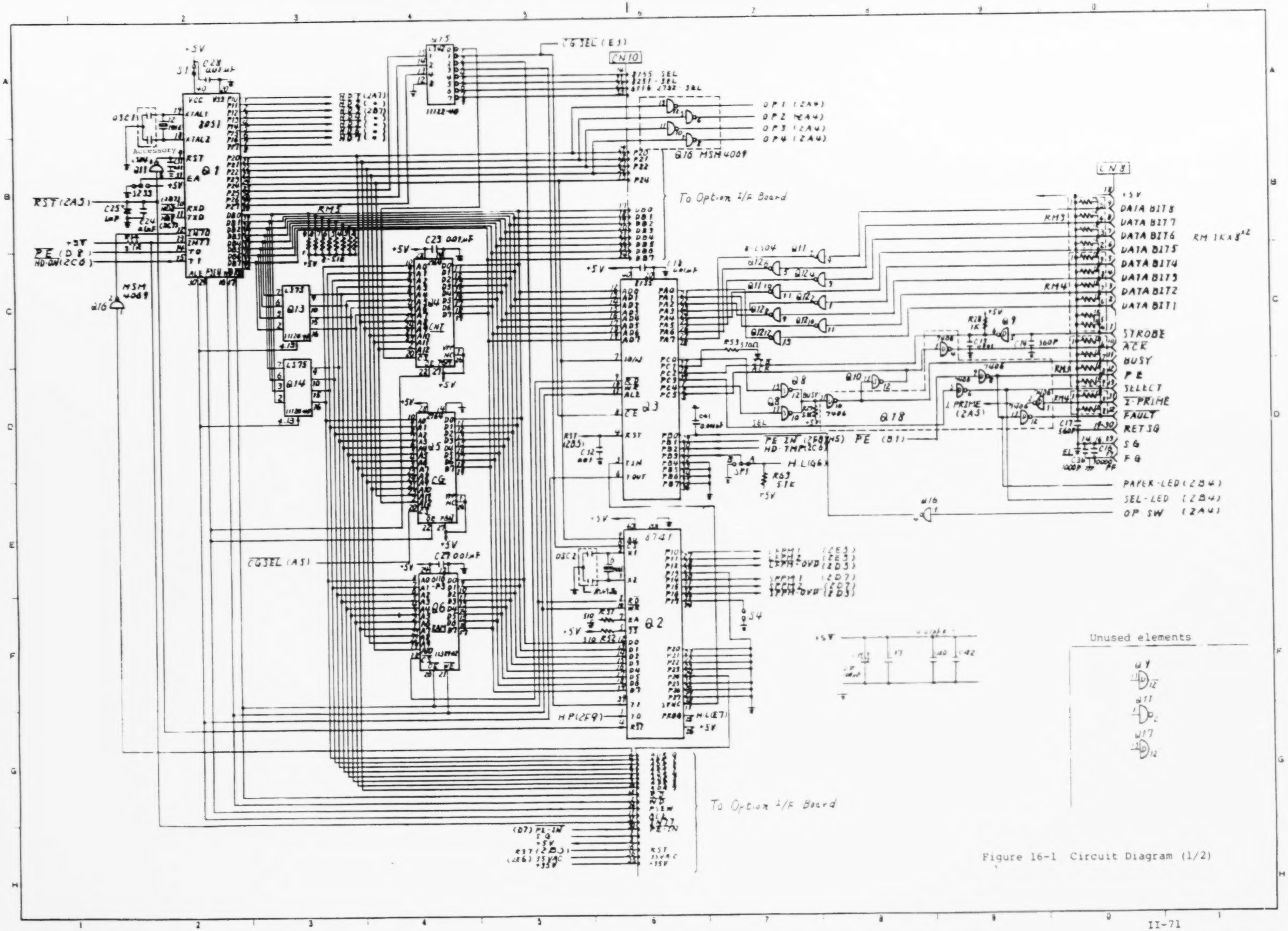

+5V
C28 .001uF
OSC1
Accessory
8051
Q1
VCC
XTAL1
XTAL2
RST
EA
RXD
TXD
INT0
INT1
T0
T1
ALE
RST (2A5)
C25
C24
+5V
PE (D8)
HD-ON (2C0)
MSM 4069
Q16
Q15
RM5
LS373
Q13
LS373
Q14
C23 .001uF
Q4
CNI
Q5
CG
C27 .001uF
CGSEL (A5)
Q6
CG SEL (E3)
CN10
8155 SEL
8257 SEL
6116 2732 SEL
OP1 (2A4)
OP2 (2A4)
OP3 (2A4)
OP4 (2A4)
Q16 MSM4069
To Option I/F Board
8155
Q3
PA0
PA1
PA2
PA3
PA4
PA5
PA6
PA7
PC0
PC1
PC2
PC3
PC4
PC5
PB0
PB1
PB2
PB3
PB4
PB5
PB6
PB7
PE IN (2F8)
HD TMP (2C0)
HL (G6)
PE (B1)
R63 51K
SP1
Q8
Q10
Q18
Q11
Q12
7406
BUSY
SEL
I PRIME (2A5)
CN8
+5V
DATA BIT8
DATA BIT7
DATA BIT6
DATA BIT5
DATA BIT4
DATA BIT3
DATA BIT2
DATA BIT1
STROBE
ACK
BUSY
PE
SELECT
I PRIME
FAULT
RET SG
SG
FG
RM3
RM4
RM 1K x 8 x2
PAPER-LED (2B4)
SEL-LED (2B4)
OP SW (2A4)
Q16
8741
Q2
OSC2
LFPM1 (2E3)
LFPM2 (2E3)
LFPH-OVD (2D3)
SPPM1 (2D7)
SPPM2 (2D7)
SPPH-OVD (2D3)
S4
HP (2F9)
HL (E7)
+5V
To Option I/F Board
(D7) PE-IN
SG
+5V
RST (2B3)
(2E6) 35VAC
+35V
Unused elements
Q9
Q11
Q17

Figure 16-1 Circuit Diagram (1/2)

FIGURE 2

SERVICING AND REPAIRING DOT-MATRIX PRINTERS
UNIT II

JOB SHEET #8 — TROUBLESHOOT AN ML92 PRINTER WHEN THE CARRIAGE KEEPS RUNNING RIGHT OR LEFT AT POWER-UP

A. Tools and equipment

1. Printer as selected by instructor
2. Maintenance manual for printer
3. Hand tools
4. DVOM
5. Dual-phase oscilloscope
6. Troubleshooting log (from previous job sheet)
7. Replacement parts as required

B. Procedure

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1. Sign on your troubleshooting log, and refer to the fold-out schematics that accompany Job Sheet #7 for any needed assistance
2. Disassemble the printer as required for each of the following activities
3. Check to see if the home sensor is okay
    a. If it is, go on to next checkpoint
    b. If it isn't, check the seating of connector CN9 and reseat the connector properly
    c. If that isn't the problem, replace the home sensor

JOB SHEET #8

4. Check the microprocessors for faulty operation

    a. If this is the problem, check the oscillation of the crystal and replace Q1, Q2, and Q3 if they are faulty

    b. Reassemble printer, turn power ON, and run a printer self test

5. Sign off your troubleshooting log

6. Have your instructor check your work, including the printer self test

7. Clean up area and return tools and equipment to proper storage or prepare for next job sheet as directed by your instructor

SERVICING AND REPAIRING DOT-MATRIX PRINTERS
UNIT II

JOB SHEET #9 — TROUBLESHOOT AN ML92 PRINTER WHEN THE CARRIAGE VIBRATES AT POWER-UP

A. Tools and equipment

1. Printer as selected by instructor
2. Maintenance manual for printer
3. Hand tools
4. DVOM
5. Dual-phase oscilloscope
6. Troubleshooting log (from previous job sheet)
7. Replacement parts as required

B. Procedure

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1. Sign on your troubleshooting log, and refer to the fold-out schematics that accompany Job Sheet #7 for any needed assistance
2. Disassemble the printer as required for each of the following activities
3. Check the synchro belt for proper tension
    a. If it is okay, move on to the next checkpoint
    b. If tension is not okay, adjust it
4. Check to see if the space drive motor is operating properly
    a. If it is, move on to the next check point
    b. If it isn't, the TR2 is probably faulty, so replace the MLPC circuit board

JOB SHEET #9

5. Check to see if the ribbon feed is tight
    a. If it is, move on to the next check point
    b. If it isn't, turn the power off and check the ribbon feed by moving the carriage right and left manually, and make required adjustments to the ribbon drive assembly as outlined in a previous job sheet
6. Check for proper voltage of +35V
    a. If voltage is okay, move on to the next checkpoint
    b. If voltage is not okay, replace the MLPC circuit board
7. Check to see if the space motor driver is faulty
    a. If driver is faulty, it means that TR13, Q10, and Q11 are probably faulty and the MLPC circuit board should be replaced
    b. Reassemble printer, turn power ON, and run a printer self test
8. Sign off your troubleshooting log
9. Have your instructor check your work, including the printer self test
10. Clean up area and return tools and equipment to proper storage, or prepare for next job sheet as directed by your instructor

SERVICING AND REPAIRING DOT-MATRIX PRINTERS
UNIT II

JOB SHEET #10 — TROUBLESHOOT AN ML92 PRINTER WHEN THE CIRCUIT BREAKER OPENS AT POWER-UP

A. Tools and equipment

1. Printer as selected by instructor
2. Maintenance manual for printer
3. Hand tools
4. DVOM
5. Dual-phase oscilloscope
6. Troubleshooting log (from previous job sheet)
7. Replacement parts as required

B. Procedure

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1. Sign on your troubleshooting log, and refer to the fold-out schematics that accompany Job Sheet #7 for any needed assistance
2. Disassemble the printer as required for each of the following activities
3. Check to see if the rectifier circuit is okay
   a. If it is, move on to the next checkpoint
   b. If it isn't, D1 to D4 are faulty, so replace the MLPC circuit board
4. Check for proper voltage at CN1
   a. If it is okay, move on to the next checkpoint
   b. If voltage is not okay, TFMR is probably faulty and should be replaced or the LEPM circuit board may be faulty and it should be replaced

JOB SHEET #10

5. Check to see if the protective circuit is okay
   a. If it is not, then Q20, SCR, TR1 to TR3, and TR7 are probably faulty, so replace the MLPC board
   b. Reassemble printer, turn power ON, and run a printer self test
6. Sign off your troubleshooting log
7. Have your instructor check your work, including the printer self test
8. Clean up area and return tools and equipment to proper storage, or prepare for next job sheet as directed by your instructor

SERVICING AND REPAIRING DOT-MATRIX PRINTERS
UNIT II

JOB SHEET #11 — TROUBLESHOOT AN ML92 PRINTER WHEN PRINTING OR SPACING OPERATIONS DO NOT START WITH DATA INPUT

A. Tools and equipment

1. Printer as selected by instructor
2. Maintenance manual for printer
3. Hand tools
4. DVOM
5. Dual-phase oscilloscope
6. Troubleshooting log (from previous job sheet)
7. Replacement parts as required

B. Procedure

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1. Sign on your troubleshooting log, and refer to the fold-out schematics that accompany Job Sheet #7 for any needed assistance
2. Disassemble the printer as required for each of the following activities
3. Check to see if the PAPER LED lights
    a. If it does, move on to the next checkpoint
    b. If it doesn't, check for paper being out or low or improperly inserted, and supply new paper
    c. If that isn't the problem, check the CN11 connector and reseat it
    d. If that isn't the problem, replace the paper-out detection microswitch

JOB SHEET #11

4. Check to see if the SEL LED lights
    a. If it does, move on to next checkpoint
    b. If it doesn't, depress the SEL switch and see if the SEL LED lights
    c. If it doesn't light, then replace the LEPF circuit board, and if that isn't the problem, then replace the MLPC circuit board
5. Check for proper interface signals
    a. If they're okay, move on to next checkpoint
    b. If they're not okay, check the seating on interface cable CN 8 and reseat it properly
6. Check the microprocessors for proper operation
    a. If Q1, Q2, and Q3 are faulty, then replace the MLPC circuit board
    b. Reassemble the printer, turn power ON, and run a printer self test
7. Sign off your troubleshooting log
8. Have your instructor check your work, including the printer self test
9. Clean up area and return tools and equipment to proper storage, or prepare for next job sheet as directed by your instructor

SERVICING AND REPAIRING DOT-MATRIX PRINTERS
UNIT II

JOB SHEET #12 — TROUBLESHOOT AN ML92 PRINTER WHEN THE PRINTER SPACES BUT WILL NOT PRINT

A. Tools and equipment

1. Printer as selected by instructor
2. Maintenance manual for printer
3. Hand tools
4. DVOM
5. Dual-phase oscilloscope
6. Troubleshooting log (from previous job sheet)
7. Replacement parts as required

B. Procedure

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1. Sign on your troubleshooting log, and refer to the fold-out schematics that accompany Job Sheet #7 for any needed assistance
2. Disassemble the printer as required for each of the following activities
3. Check to see if proper power is getting to the printhead
    a. If it is, move on to the next checkpoint
    b. If it isn't, check the contact of the printhead cable, and reseat it properly
4. Check to see that the printhead itself is okay
    a. If it is, move on to the next checkpoint
    b. If it isn't, replace the printhead

JOB SHEET #12

5. Check to see if the printhead driver is okay
    - a. If it is, move on to the next checkpoint
    - b. If it isn't, TR9 and TR11 are probably faulty, so replace the MLPC board
6. Check to see if the sound of the printhead operating can be heard
    - a. If it can, check the gap between the printhead and the platen as outlined in a previous job sheet
    - b. Reassemble the printer, turn the power ON, and run a printer self test
7. Sign off your troubleshooting log
8. Have your instructor check your work, including the printer self test
9. Clean up area and return tools and equipment to proper storage or prepare for next job sheet as directed by your instructor

SERVICING AND REPAIRING DOT-MATRIX PRINTERS
UNIT II

JOB SHEET #13 — TROUBLESHOOT AN ML92 PRINTER WHEN THE PRINTER PRINTS BUT WILL NOT SPACE

A. Tools and equipment

1. Printer as selected by instructor
2. Maintenance manual for printer
3. Hand tools
4. DVOM
5. Dual-phase oscilloscope
6. Troubleshooting log (from previous job sheet)
7. Replacement parts as required

B. Procedure

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1. Sign on your troubleshooting log, and refer to the fold-out schematics that accompany Job Sheet #7 for any needed assistance
2. Disassemble the printer as required for each of the following activities
3. Check to see if the carriage is vibrating
    a. If it isn't, move on to the next checkpoint
    b. If it is, check and adjust the tension of the synchro belt
    c. If that isn't the trouble, TR2 and TR4 are probably faulty, so replace the MLPC circuit board

JOB SHEET #13

4. Check to see if the microprocessors are operating properly
    a. If they are, move on to the next checkpoint
    b. If they are not, Q1, Q2, and Q3 are probably faulty, so replace the MLPC circuit board
5. Check to see if the space motor driver is faulty
    a. If it is, Q9, Q10, and Q11, as well as TR14 are faulty, so replace the MLPC circuit board
    b. Reassemble printer, turn power ON, and run a printer self test
6. Sign off your troubleshooting log
7. Have your instructor check your work, including the printer self test
8. Clean up area and return tools and equipment to proper storage or prepare for next job sheet as directed by your instructor

SERVICING AND REPAIRING DOT-MATRIX PRINTERS
UNIT II

JOB SHEET #14 — TROUBLESHOOT AN ML92 PRINTER WHEN THE PRINTHEAD WILL NOT RETURN TO HOME POSITION AFTER PRINTING

A. Tools and equipment

1. Printer as selected by instructor
2. Maintenance manual for printer
3. Hand tools
4. DVOM
5. Dual-phase oscilloscope
6. Troubleshooting log (from previous job sheet)
7. Replacement parts as required

B. Procedure

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1. Sign on your troubleshooting log, and refer to the fold-out schematics that accompany Job Sheet #7 for any needed assistance
2. Disassemble the printer as required for each of the following activities
3. Check to see if the microprocessors are operating properly
    a. If they are, move on to the next checkpoint
    b. If they aren't, replace the MLPC circuit board
4. Check to see if the space motor driver is faulty
    a. If it is, then TR13, Q9, Q10, and Q11 are faulty, so replace the MLPC circuit board
    b. Reassemble printer, turn the power ON, and run a printer self test

JOB SHEET #14

5. Sign off your troubleshooting log

6. Have your instructor check your work, including the printer self test

7. Clean up area and return tools and equipment to proper storage or prepare for next job sheet as directed by your instructor

SERVICING AND REPAIRING DOT-MATRIX PRINTERS
UNIT II

JOB SHEET #15 — TROUBLESHOOT AN ML92 PRINTER WHEN IT WILL NOT PERFORM LINE FEED FUNCTIONS

A. Tools and equipment

1. Printer as selected by instructor
2. Maintenance manual for printer
3. Hand tools
4. DVOM
5. Dual-phase oscilloscope
6. Troubleshooting log (from previous job sheet)
7. Replacement parts as required

B. Procedure

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1. Sign on your troubleshooting log, and refer to the fold-out schematics that accompany Job Sheet #7 for any needed assistance
2. Disassemble the printer as required for each of the following activities
3. Check to see if the paper feeds smoothly when you feed it manually by turning the platen knob
    a. If it does, move on to the next checkpoint
    b. If it doesn't, check the gear of the line feed motor and adjust it
4. Check to see if the line feed motor driver is okay
    a. If it is, move on to the next checkpoint
    b. If it isn't, Q9 and Q10 are faulty, so replace the MLPC circuit board

JOB SHEET #15

5. Check to see if the microprocessors are operating properly
    a. If they are, move on to the next checkpoint
    b. If they are not okay, replace the MLPC circuit board
6. Check to see if the LF motor is okay
    a. If it isn't, check the resistance of the LF motor coil, and replace the LF motor, if needed
    b. Reassemble printer, turn power ON, and run a printer self test
7. Sign off your troubleshooting log
8. Have your instructor check your work, including the printer self test
9. Clean up area and return tools and equipment to proper storage or prepare for next job sheet as directed by your instructor

SERVICING AND REPAIRING DOT-MATRIX PRINTERS
UNIT II

JOB SHEET #16 — TROUBLESHOOT AN ML92 PRINTER WHEN THE PAPER-OUT DETECTOR IS NOT WORKING

A. Tools and equipment

1. Printer as selected by instructor
2. Maintenance manual for printer
3. Hand tools
4. DVOM
5. Dual-phase oscilloscope
6. Troubleshooting log (from previous job sheet)
7. Replacement parts as required

B. Procedure

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1. Sign on your troubleshooting log, and refer to the fold-out schematics that accompany Job Sheet #7 for any needed assistance
2. Disassemble the printer as required for each of the following activities
3. Check to see if the PAPER LED lights
   a. If it does, move on to the next checkpoint
   b. If it doesn't, replace the MLPC circuit board
4. Check to see if the paper-out detection microswitch is okay
   a. If it is, move on to the next checkpoint
   b. If it isn't, replace the microswitch

JOB SHEET #16

5. Check to see if the microprocessors are operating properly
    a. If they aren't, replace the MLPC circuit board
    b. Reassemble the printer, turn the power ON, and run a printer self test
6. Sign off your troubleshooting log
7. Have your instructor check your work, including the printer self test
8. Clean up area and return tools and equipment to proper storage or prepare for next job sheet as directed by your instructor

SERVICING AND REPAIRING DOT-MATRIX PRINTERS
UNIT II

JOB SHEET #17 — TROUBLESHOOT AN ML92 PRINTER WHEN SOME CHARACTERS ARE PRINTED AND OTHER CHARACTERS ARE PRINTED WRONG

A. Tools and equipment

1. Printer as selected by instructor
2. Maintenance manual for printer
3. Hand tools
4. DVOM
5. Dual-phase oscilloscope
6. Troubleshooting log (from previous job sheet)
7. Replacement parts as required

B. Procedure

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1. Sign on your troubleshooting log, and refer to the fold-out schematics that accompany Job Sheet #7 for any needed assistance
2. Disassemble the printer as required for each of the following activities
3. Check to see if the interface cable is properly connected
    a. If it is, move on to the next checkpoint
    b. If it isn't, reseat it properly
4. Check to see if the character generator is okay
    a. If it is, move on to the next checkpoint
    b. If it isn't, Q5 is faulty, so replace Q5

JOB SHEET #17

5. Check to see if the microprocessors are operating properly
    a. If they aren't, replace the MLPC circuit board
    b. Reassemble the printer, turn the power ON, and run a printer self test
6. Sign off your troubleshooting log
7. Have your instructor check your work, including the printer self test
8. Clean up area and return tools and equipment to proper storage or prepare for next job sheet as directed by your instructor

SERVICING AND REPAIRING DOT-MATRIX PRINTERS
UNIT II

JOB SHEET #18 — TROUBLESHOOT AN ML92 PRINTER WHEN SOME DOTS IN THE MATRIX ARE NOT PRINTED

A. Tools and equipment

1. Printer as selected by instructor
2. Maintenance manual for printer
3. Hand tools
4. DVOM
5. Dual-phase oscilloscope
6. Troubleshooting log (from previous job sheet)
7. Replacement parts as required

B. Procedure

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1. Sign on your troubleshooting log, and refer to the fold-out schematics that accompany Job Sheet #7 for any needed assistance
2. Disassemble the printer as required for each of the following activities
3. Check to see if the printhead is okay
    a. If it is, move on to the next checkpoint
    b. If it isn't, replace the printhead
4. Check to see if the printhead cable is okay
    a. If it is, move on to the next checkpoint
    b. If it isn't, reseat the cable, and if needed, replace it

JOB SHEET #18

5. Check to see if the printhead driver is okay
   a. If it isn't, replace the MLPC board
   b. Reassemble the printer, turn the power ON, and run a printer self test
6. Sign off your troubleshooting log
7. Have your instructor check your work, including the printer self test
8. Clean up area and return tools and equipment to proper storage or prepare for next job sheet as directed by your instructor

SERVICING AND REPAIRING DOT-MATRIX PRINTERS
UNIT II

JOB SHEET #19 — TROUBLESHOOT AN ML92 PRINTER FOR AN OPEN CIRCUIT BREAKER

A. Tools and equipment

1. Printer as selected by instructor
2. Maintenance manual for printer
3. Hand tools
4. DVOM
5. Dual-phase oscilloscope
6. Troubleshooting log (from previous job sheet)
7. Replacement parts as required

B. Procedure

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1. Sign on your troubleshooting log, and refer to the fold-out schematics that accompany Job Sheet #7 for any needed assistance
2. Disassemble the printer as required for each of the following activities
3. Check to see if the rectifier circuit is okay
    a. If it is, move on to the next checkpoint
    b. If it isn't, D1 to D4 are faulty, so replace the MLPC circuit board
4. Check to see if the protective circuit is working okay
    a. If it isn't, Q20, SCR, TR1 to TR3, and TR7 are faulty, so replace the MLPC circuit board
    b. Reassemble the printer, turn power ON, and run a printer self test

JOB SHEET #19

5. Sign off your troubleshooting log

6. Have your instructor check your work, including the printer self test

7. Clean up area and return tools and equipment to proper storage or prepare for next job sheet as directed by your instructor

SERVICING AND REPAIRING DOT-MATRIX PRINTERS
UNIT II

JOB SHEET #20 — TROUBLESHOOT AN ML92 PRINTER WHEN THE SYSTEM FUSE BLOWS

A. Tools and equipment

1. Printer as selected by instructor
2. Maintenance manual for printer
3. Hand tools
4. DVOM
5. Dual-phase oscilloscope
6. Troubleshooting log (from previous job sheet)
7. Replacement parts as required

B. Procedure

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1. Sign on your troubleshooting log, and refer to the fold-out schematics that accompany Job Sheet #7 for any needed assistance
2. Disassemble the printer as required for each of the following activities
3. Check to see if the rectifier circuit is faulty
    a. If it is, D6 to D9 are faulty, so replace the MLPC board
    b. Reassemble the printer, turn power ON, and run a printer
4. Sign off your troubleshooting log
5. Have your instructor check your work, including the printer self test
6. Clean up area and return tools and equipment to proper storage or prepare for next job sheet as directed by your instructor

SERVICING AND REPAIRING DOT-MATRIX PRINTERS
UNIT II

JOB SHEET #21 — TROUBLESHOOT AN ML92 PRINTER WHEN THE SWITCHES ON THE OPERATION PANEL WILL NOT WORK

A. Tools and equipment

1. Printer as selected by instructor
2. Maintenance manual for printer
3. Hand tools
4. DVOM
5. Dual-phase oscilloscope
6. Troubleshooting log (from previous job sheet)
7. Replacement parts as required

B. Procedure

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1. Sign on your troubleshooting log, and refer to the fold-out schematics that accompany Job Sheet #7 for any needed assistance
2. Disassemble the printer as required for each of the following activities
3. Check to see if the SEL switch works and if the SEL LED lights
    a. If it does, move on to the next checkpoint
    b. If it doesn't, check the CN91 and CN5 connectors and reseat them properly
    c. If that isn't the problem, Q92 and Q93 ar faulty, so replace the LEPF circuit board
    d. If that isn't the problem, SW92 is faulty, so replace the MLPC circuit board

JOB SHEET #21

4. Check to see if the LINE FEED and FORM FEED switches work properly
   a. If they do, move on to the next checkpoint
   b. If they do not, Q92 and Q93 are faulty, so replace the LEPF circuit board
5. Check to see if the TOF SET switch is working properly
   a. If it is, move on to the next check point
   b. If it isn't, Q92 and Q93 are faulty, so replace the LEPF circuit board
6. Check to see if the rotary switch works properly
   a. If it doesn't, Q92, Q93, and SW95 are faulty, so replace the LEPF circuit board
   b. Reassemble the printer, turn power ON, and run a printer
7. Sign off your troubleshooting log
8. Have your instructor check your work, including the printer self test
9. Clean up area and return tools and equipment to proper storage or prepare for next job sheet as directed by your instructor

SERVICING AND REPAIRING DOT-MATRIX PRINTERS
UNIT II

JOB SHEET #22 — TROUBLESHOOT AN ML92 PRINTER WHEN THE PRINT IS NOT DARK ENOUGH

A. Tools and equipment

1. Printer as selected by instructor
2. Maintenance manual for printer
3. Hand tools
4. DVOM
5. Dual-phase oscilloscope
6. Troubleshooting log (from previous job sheet)
7. Replacement parts as required

B. Procedure

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1. Sign on your troubleshooting log, and refer to the fold-out schematics that accompany Job Sheet #7 for any needed assistance
2. Disassemble the printer as required for each of the following activities
3. Check to see if the ribbon can still be used
    a. If the ribbon still has useful life left, move on to the next checkpoint
    b. If the ribbon is no longer usable, replace it
4. Check the +35V line voltage to make sure it is okay
    a. If voltage is okay, move on to the next checkpoint
    b. If voltage is not okay, replace the MLPC circuit board

JOB SHEET #22

5. Check the printhead to make sure it is okay
    a. If the printhead is okay, move on to the next checkpoint
    b. If the printhead is faulty, replace it
6. Check to see if the printhead driver is okay
    a. If it is okay, move on to the next checkpoint
    b. If it is not okay, TR9 and TR11 are faulty, so replace the MLPC circuit board
7. Check for proper gap between the printhead and the platen
    a. If the printhead-platen gap is okay, move on to the next checkpoint
    b. If the printhead-platen gap is faulty, adjust the gap as outlined in a previous job sheet
8. Check to see if the ribbon feed is functioning properly
    a. If the ribbon feed appears to be faulty, turn the power OFF, and see if the ribbon feeds properly when the carriage is moved left and right manually
    b. If the ribbon feed is still faulty, check the ribbon drive assembly and adjust as required
    c. Reassemble the printer, turn power ON, and run a printer self test
9. Sign off your troubleshooting log
10. Have your instructor check your work, including the printer self test
11. Clean up area and return tools and equipment to proper storage or prepare for next job sheet as directed by your instructor

SERVICING AND REPAIRING DOT-MATRIX PRINTERS
UNIT II

NAME ______________________

TEST

1. Match the terms on the right with their correct definitions.

______a. A schematic or block diagram notation for a connector

______b. The measurement of the density of characters in a horizontal line of print

______c. Another method of measuring the density of characters in a horizontal line of print

______d. Printing at a pitch of 10 CPI which gives clear, easy-to-read letters and is a popular pitch for business letters and reports

______e. Printing at a pitch of 12 CPI which puts more words on a page and is popular for business uses and for conserving space in long reports

______f. Printing at a pitch of 15 CPI which is a popular pitch for tables and charts where much information has to go into limited space

______g. A pitch that balances out white space between wide letters such as "M" and narrow letters such as "I" to make a printed page look better

______h. A measurement of how fast a printer prints

______i. The measurement of the number of lines in a vertical inch of space

______j. Printing at 8 LPI

______k. Printing at 6 LPI

______l. Printing at 4 LPI

______m. Printing at 2 LPI

1. Pica type
2. Double space
3. LPI
4. CN
5. Elite type
6. Single space
7. CPI
8. Condensed type
9. Space and a half
10. Pitch
11. Triple space
12. Proportional pitch
13. CPS

TEST

2. Select true statements concerning design features of the Microline 92 dot-matrix printer by placing an "X" in the appropriate blanks.

______a. The ML92 is a desk-top, serial-type, dot-matrix printer designed for use with personal computers

______b. The ML92 components include a print mechanism, a control unit, an operation panel, and a power supply housed in a case with an access cover that is easy to remove

______c. The ML92's 5 × 9 matrix permits printing with true descenders, expanded printing that provides double-width characters, underlining, graphics capabilities, and letter quality printing

______d. The ML92 is rated as a high-speed printer capable of printing only 45 cps

3. Match ML92 electronic controls with their functions.

______a. Switches AC power ON and OFF

______b. Lights up red when power is switched ON

______c. Lights up red when it detects printer is out of paper

______d. Changes the online/offline status of the printer

______e. Lights up red when printer is in online status and goes out when printer is in offline status

______f. Works when printer is in offline status, and feeds paper to the next top-of-form position when depressed

______g. Works when printer is in offline status, feeds paper one line at a time when depressed, and is used for the printer self test function

______h. Selects paper lengths

______i. Select printer functions

1. FORM FEED switch
2. SEL LED
3. DIP switch
4. AC power switch
5. FORM LENGTH rotary switch
6. Power LED
7. Paper LED
8. LINE FEED switch
9. SEL switch

TEST

4. Match ML92 mechanical controls with their functions.

______a. Controls paper feed pressure and is closed for cut-sheet or roll paper and open for sprocket paper

______b. Adjusts printing pressure according to paper type and thickness

______c. Manual control for feeding paper up and down

______d. Manual control for guiding paper, and it is set upright or open for cut-sheet and roll paper and closed for sprocket paper

1. Platen knob
2. Head-gap adjusting lever
3. Guide bar
4. Paper-clamp lever

5. Match ML92 selection and protection controls with their functions.

______a. Protects the printer from AC input overcurrent

______b. A switch designed for a special model that permits selection of either 220V or 240V power supply

______c. Selects the 7 or 8-bit data bit length

1. Voltage-select switch
2. Jumper plug
3. Circuit breaker

6. Select true statements concerning printhead operations on the ML92 by placing an "X" in the appropriate blanks.

______a. When the printhead is not printing, the individual print wires are held in the wire guide by the attraction of an electronic force

______b. When a print signal is received by an individual print wire, the magnetic field is nullified and the print wire is propelled toward the platen by a spring

______c. The force of the spring drives the print wire through the tip of the wire guide where it strikes the paper through the ribbon and prints a dot

7. Complete statements concerning ML92 printhead characteristics by circling the word(s) that best completes each statement.

a. The printhead has a built-in (**thermistor, resistor**) to prevent overheating from continuous bidirectional printing

b. Anytime the coil temperature exceeds (**194°F, 100°F**) the (**thermistor, resistor**) signals the control circuit to switch from bidirectinal to unidirectional print, and the control circuitry stops the printer until the coil cools below the limit

TEST

8. Select true statements concerning spacing and carriage operations on the ML92 by placing an "X" in the appropriate blanks.

    _____a. The carriage with the printhead mounted on it is driven by a stepper motor which moves the carriage along upper and lower carriage shafts

    _____b. As the stepper motor rotates clockwise, the carriage moves from left to right

    _____c. As the stepper motor rotates counterclockwise, the carriage moves from right to left to return the carriage to its home position

    _____d. The carriage movement causes the home sensor plate to pass through the home sensor slit where it intercepts light from a pair of light-emitting and photo diodes, and this generates a pulse which stops the stepper motor and leaves the carriage in its start position

9. Complete statements concerning ribbon feed operations on the ML92 by circling the word(s) that best completes each statement.

    a. The ribbon feed operations are basically accomplished by (**the same stepper motor force that drives the carriage, a separate stepper motor**)

    b. As the stepper motor rotates clockwise and moves the carriage from left to right, the ribbon drive gear engages the left ribbon spool causing it to turn clockwise, and this feeds the ribbon to the (**left, right**)

    c. As the stepper motor rotates counterclockwise and moves the carriage from right to left, the ribbon drive gear engages the right ribbon spool causing it to turn counterclockwise and feed the ribbon to the (**right, left**)

    d. The eyelet control cams right and left and the eyelet detector lever work in conjunction with the (**detent spring, idler gear**) to permit the ribbon to idle at the appropriate time or to switch ribbon feed from one direction to the other at the appropriate time

10. Complete statements concerning paper feed operation on the ML92 by circling the word(s) that best completes each statement.

    a. The paper feed operations originate with (**the stepper motor, the paper control mechanism**) mounted on the left side of the frame

    b. As the stepper motor rotates, it transmits power through (**an accelerator gear, a reduction gear**) to operate the fixed-pin platen, and the power is transmitted through an idler gear to the tractor unit

    c. The paper-clamp lever permits paper to be inserted when it is (**open, closed**) and helps feed paper when it is (**open, closed**)

TEST

11. Complete statements concerning paper-out detection devices on the ML92 by circling the word(s) that best completes each statement.

    a. When continuous paper is fed from the rear of the printer, the paper pressure prevents the microswitch actuator from falling into the groove of the paper separator, but when remaining paper length is about **(2", 3")** the actuator turns the microswitch ON to indicate the printer is almost out of paper

    b. The paper-out detection for continuous paper fed from the bottom is also an actuator-microswitch arrangement, but in the case of paper feeding from the bottom, the microswitch is activated when there is about **(1", 2")** of paper remaining

12. Select true statements concerning printhead gap adjustment by placing an "X" in the appropriate blanks.

    ______a. The gap between the platen and the printhead is controlled by moving the head-gap adjusting lever in or out

    ______b. When the eccentric collars are moved clockwise, the upper carriage shaft moves the printhead closer to the platen, and when the collars move counterclockwise, the printhead moves farther away from the platen

    ______c. Since an eccentric locking bolt secures the eccentric collars, the bolt can be loosened to obtain any desired printhead gap adjustment and then the bolt is retightened

    ______d. Shifting the head-gap adjusting lever manually will change the gap between the printhead and the platen by 0.15mm

13. Complete the following list of control board features of the ML92 by circling the word(s) that best completes each statement.

    a. The control section is essentially a single board microprocessor with **(two, three)** microprocessors and a DC power supply

    b. The 8051 is **(an 8-bit microprocessor, a 16-bit microprocessor)** run by a 12 MHz clock, and contains a 128-byte RAM and two 8-bit timers

    c. The 8741 is an 8-bit microprocessor run by a **(6 MHz clock, 12 MHz clock)** and contains a 1-K ROM, a 64-byte RAM, and an 8-bit timer

    d. Other major board components include two 8-kilobyte ROMs, one 2-kilobyte RAM, and one 256-byte RAM with **(I/O ports, battery backup)**

    e. The 8051 microprocessor generates timing signals, addresses ROM and RAM through the data bus, and uses some of its I/O ports to control and select from the **(nine, six)** heads in the printhead

    f. The 8741 microprocessor generates **(timing, interrupt)** signals for the motors and uses its Port 1 to control the space motor and the line feed motor

    g. The 256-byte RAM contains a timer and I/O ports and is used to control the **(parallel, serial)** interface

TEST

14. Select true statements concerning motor specifications on the ML92 by placing an "X" in the appropriate blanks.

    _____a. The carriage is driven by a space motor which is a three-phase stepper motor with a step angle of 1.8°

    _____b. When the space motor advances 12 steps, the carriage moves 2.54mm or 0.1 inch

    _____c. Line feed operation is powered by a line-feed motor which is a two-phase stepper motor with a step angle of 7.5°

    _____d. When the line-feed motor advances 24 steps, the paper is fed 4.23mm or 0.17 inch

    _____e. When the line-feed motor advances 18 steps, the paper is fed 3.18mm or 0.13 inch

15. Complete the following list of protective devices on the ML92 by circling the word(s) that best completes each statement.

    a. The power supply is so designed that a constant current flows to both the printhead and space motor even if the (**35V, 120V**) line voltage changes because of input or load variations

    b. The printer also has a (**fuse, protective circuit**) to detect trouble in the peripheral circuits or drivers of the printhead, space motor, and line-feed motor

    c. The power transformer has a built-in thermal (**fuse, lockout**) which prevents the transformer from being burned due to an abnormally high temperature rise

    d. Anytime the printhead temperature exceeds about 210°F during continuous printing, the printer goes from a unidirectinal to a bidirectional printing mode until the head (**cools down, is checked or replaced**)

    e. When the printhead cools down, bidirectional printing resumes, but if the temperature doesn't cool after 66 blocks of unidirectional printing, the entire printing operation is shut down (**until the head cools, until all circuits have been checked**)

16. Arrange in order the steps in initializing the ML92 by placing the correct sequence number in the appropriate blank.

    _____a. Initializing the printer means clearing the circuitry, setting the carriage at the home position, and placing the printer in a ready-for-input mode

    _____b. During the initialization routine, the BUSY signal of the interface is held at 1 so the printer cannot accept print data

TEST

______c. When initializing is complete, the BUSY signal goes to 0 and the printer is in the ready-for-input mode

______d. Initialization starts when the AC power is turned on causing a RESET signal to be sent to the 8051 microprocessor to clear it

______e. After the clearing, the program runs and the carriage returns to the home position

17. Select true statements concerning the operating cycle in an ML92 by placing an "X" in the appropriate blanks.

______a. When the AC power switch is turned ON, a RESET signal is sent to the main microprocessor to clear the printer circuitry and put the printer in a ready-for-input state with the BUSY signal at zero

______b. Data bits are input to the I/O port as 8-bit parallel data while the BUSY signal is at 0 along with a $\overline{\text{STROBE}}$ signal sent by the host computer

______c. The parallel data is latched internally at the rising edge of the $\overline{\text{STROBE}}$ signal, and after the data is latched, the BUSY signal goes back to 1 and the main microprocessor starts processing the input data

______d. The microprocessor determines whether the data is print data or control data so that print data is written into RAM and control data causes whatever is written in RAM to be printed

______e. When input data amounts to the quantity of one print line, the data is printed, and as the processing is completed, the busy signal is set to 0 again and a pulse is sent to the $\overline{\text{ACKNOWLEDGE}}$ terminal

______f. As the BUSY signal returns to 0, the printer is back in a ready-for-input state and the input-print cycle can be repeated

18. Complete statements concerning some ML92 problems and suggested solutions by circling the word(s) that best completes each statement.

a. Power LED does not light

1) Probably caused by an improperly connected AC power supply cable or (**an open circuit breaker, a blown fuse**)

2) Solve the problem by properly connecting the AC power plug, or turn the AC power switch OFF and reset the circuit breaker by (**pressing it down, replacing the fuse**)

b. The PAPER LED lights

1) Probably caused by paper running out or (**too little paper, too much paper pressure**)

2) Solve the problem by (**adjusting pressure, installing new paper**)

TEST

c. Paper won't feed

1) Probably caused by the paper-clamp lever being (**open, closed**) when cut-sheet or roll paper is being used or by holes in paper not properly set on the sprocket pins when sprocket paper is being used

2) Solve the problem by installing the paper properly or (**opening, closing**) the head-gap lever

d. Paper tears

1) Probably caused because wrong paper is being used, head-gap adjusting lever is not set properly, or paper is not (**installed properly, wide enough**)

2) Solve the problem by using the correct paper, changing the head-gap adjusting lever to the correct position or installing (**paper properly, wider paper**)

e. Ribbon does not print

1) Probably caused by a ribbon that's worn out or not threaded properly, but could be in the (**ribbon feed mechanism, idler gear**)

2) Solve the problem by changing the (**idler gear, ribbon**) or checking the ribbon feed mechanism

f. Printer does not operate

1) Probably caused by a blown fuse or (**one of several other problems, bad connections**)

2) Solve the problem by first turning the AC power switch OFF and then turning it ON again, then replace the fuse if needed, and (**troubleshoot the system as required, replace printhead immediately**)

19. Complete statements concerning ML92 interfaces by circling the word(s) that best completes each statement.

a. The standard interface for the ML92 is a (**serial, parallel**) interface that is centronics compatible and uses a 36-pin connector at the printer side and a 36-pin plug at the cable side

b. The printer cable should not be over (**20 feet, 10 feet**) long, and it should be a shielded cable composed of twisted-pair wires to help noise prevention

c. Optional interface boards may be installed as required:

1) A high-speed RS-232C interface with 7 (**protocols, handshakes**)

2) A (**current-loop, straight-loop**) interface

3) (**An IEEE 488, A VME**) interface

TEST

(NOTE: If the following activities have not been accomplished prior to the test, ask your instructor when they should be completed.)

20. Demonstrate the ability to:

    a. Install paper feeding devices on an ML92 printer. (Job Sheet #1)

    b. Remove the upper case on an ML92 printer and replace the system fuse. (Job Sheet #2)

    c. Replace a ribbon and install cut-sheet, roll, and sprocket-feed paper on an ML92 printer. (Job Sheet #3)

    d. Operate an ML92 printer to check control functions and run a printer self test. (Job Sheet #4)

    e. Make tension and gap adjustments on an ML92 printer. (Job Sheet #5)

    f. Remove and replace major components of an ML92 printer. (Job Sheet #6)

    g. Troubleshoot an ML92 printer when the printhead does not move at powerup. (Job Sheet #7)

    h. Troubleshoot an ML92 printer when the carriage keeps running right or left at power-up. (Job Sheet #8)

    i. Troubleshoot an ML92 printer when the carriage vibrates at power-up. (Job Sheet #9)

    j. Troubleshoot an ML92 printer when the circuit breaker opens at power-up. (Job Sheet #10)

    k. Troubleshoot an ML92 printer when printing or spacing operations do not start with data input. (Job Sheet #11)

    l. Troubleshoot an ML92 printer when the printer spaces but will not print. (Job Sheet #12)

    m. Troubleshoot an ML92 printer when the printer prints but will not space. (Job Sheet #13)

    n. Troubleshoot an ML92 printer when the printhead will not return to home after printing. (Job Sheet #14)

    o. Troubleshoot an ML92 printer when it will not perform line feed functions. (Job Sheet #15)

    p. Troubleshoot an ML92 printer when the paper-out detector is not working. (Job Sheet #16)

TEST

q. Troubleshoot an ML92 printer when some characters are not printed and other characters are printed wrong. (Job Sheet #17)

r. Troubleshoot an ML92 printer when some dots in the matrix are not printed. (Job Sheet #18)

s. Troubleshoot an ML92 printer for an open circuit breaker. (Job Sheet #19)

t. Troubleshoot an ML92 printer when the system fuse blows. (Job Sheet #20)

u. Troubleshoot an ML92 printer when the switches on the operation panel will not work. (Job Sheet #21)

v. Troubleshoot an ML92 when the print is not dark enough. (Job Sheet #22)

SERVICING AND REPAIRING DOT-MATRIX PRINTERS
UNIT II

ANSWERS TO TEST

1. a. 4
   b. 7
   c. 10
   d. 1
   e. 5
   f. 8
   g. 12
   h. 13
   i. 3
   j. 6
   k. 9
   l. 2
   m. 11

2. a,b,c

3. a. 4
   b. 6
   c. 7
   d. 9
   f. 1
   g. 8
   h. 5
   i. 3

4. a. 4
   b. 2
   c. 1
   d. 3

5. a. 3
   b. 1
   c. 2

6. b,c

7. a. Thermistor
   b. Thermistor, 194°F

8. a,b,c,d

9. a. The same stepper motor force that drives the carriage
   b. Left
   c. Right
   d. Detent spring

10. a. The stepper motor
    b. A reduction gear
    c. Open, closed

11. a. 2"
    b. 1"

12. b,c,d

ANSWERS TO TEST

13. a. Two
    b. An 8-bit microprocessor
    c. 6 MHz clock
    d. I/O ports
    e. Nine
    f. Timing
    g. Parallel

14. b,d,e

15. a. 35V
    b. Protective circuit
    c. Fuse
    d. Cools down
    e. Until the head cools

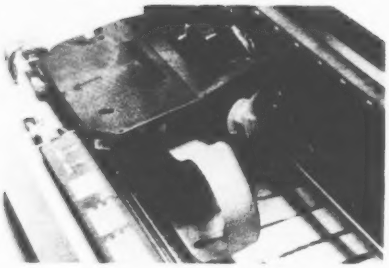
16. a. 1
    b. 4
    c. 5
    d. 2
    e. 3

17. a,b,c,d,e,f

18. a. 1) An open circuit breaker
       2) Pressing it down
    b. 1) Too little paper left
       2) Installing new paper
    c. 1) Open
       2) Closing
    d. 1) Installed properly
       2) Paper properly
    e. 1) Ribbon feed mechanism
       2) Ribbon
    f. 1) One of several other problems
       2) Troubleshoot the system as required

19. a. Parallel
    b. 10 feet
    c. 1) Protocols
       2) Current-loop
       3) An IEEE 488

20. Performance competencies evaluated according to written procedures in the job sheets



SERVICING AND REPAIRING
LETTER-QUALITY PRINTERS
UNIT III

UNIT OBJECTIVE

After completion of this unit, the student should be able to discuss the major components and general operating principles of a letter-quality printer. The student should also be able to set up and operate a letter-quality printer, disassemble and reassemble major printer components, and troubleshoot typical letter-quality printer malfunctions. These competencies will be evidenced by correctly completing the procedures outlined in the job sheets and by scoring 85 percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms related to servicing and repairing letter-quality printers with their correct definitions.
2. List major components of a PowerType letter-quality printer.
3. Match PowerType control buttons and display lamps with their functions.
4. Match PowerType slide switches with their functions.
5. Select true statements concerning setting DIP switches on a PowerType printer.
6. Solve a problem concerning the PowerType parallel interface connector.
7. Solve a problem concerning the PowerType serial interface connector.
8. Complete statements concerning PowerType logic, drive, and power supply connectors.
9. Complete statements concerning printing modes on a PowerType.

OBJECTIVE SHEET

10. Match PowerType detection mechanisms with their functions.

11. Complete statements concerning PowerType alarms and their meanings.

12. Arrange in order the steps in cleaning a PowerType printer.

13. Demonstrate the ability to:

    a. Unpack, set up, and run a printer self test on a PowerType printer. (Job Sheet #1)

    b. Remove and replace the upper case, cover open detector, and printer cover on a PowerType printer. (Job Sheet #2)

    c. Remove and replace the control panel board on a PowerType printer. (Job Sheet #3)

    d. Remove and replace the control drive board on a PowerType printer. (Job Sheet #4)

    e. Remove and replace the control logic board on a PowerType printer. (Job Sheet #5)

    f. Remove and replace the power regulator unit and the power supply unit on a PowerType printer. (Job Sheet #6)

    g. Remove and replace the printer mechanism on a PowerType printer. (Job Sheet #7)

    h. Remove and replace the paper feed assembly on a PowerType printer. (Job Sheet #8)

    i. Remove and replace the carriage motor assembly on a PowerType printer. (Job Sheet #9)

    j. Remove and replace the ribbon feed motor assembly on a PowerType printer. (Job Sheet #10)

    k. Remove and replace the hammer unit on a PowerType printer. (Job Sheet #11)

    l. Remove and replace the carriage stay on a PowerType printer. (Job Sheet #12)

    m. Remove and replace the carriage assembly on a PowerType printer. (Job Sheet #13)

    n. Remove and replace the platen cover and platen assembly on a PowerType printer. (Job Sheet #14)

OBJECTIVE SHEET

o. Remove and replace the paper chute on a PowerType printer. (Job Sheet #15)

p. Remove and replace the bail roller assembly on a PowerType printer. (Job Sheet #16)

q. Remove and replace the terminal board on a PowerType printer. (Job Sheet #17)

r. Remove and replace the printwheel home position detector on a PowerType printer. (Job Sheet #18)

s. Remove and replace the carriage home position detector on a PowerType printer. (Job Sheet #19)

t. Remove and replace the right end detector on a PowerType printer. (Job Sheet #20)

u. Remove and replace the ribbon end detector on a PowerType printer. (Job Sheet #21)

v. Remove and replace the primary and secondary fuses on a PowerType printer. (Job Sheet #22)

w. Make a mutual adjustment of the hammer and printwheel on a PowerType printer. (Job Sheet #23)

x. Make a position adjustment of the printwheel home position detector on a PowerType printer. (Job Sheet #24)

y. Adjust the platen position, idler gear backlash, and paper pressure/platen gap on a PowerType printer. (Job Sheet #25)

z. Adjust the timing belt tension on a PowerType printer. (Job Sheet #26)

aa. Adjust the carriage home position detector on a PowerType printer. (Job Sheet #27)

bb. Adjust the carriage right end detector on a PowerType printer. (Job Sheet #28)

cc. Adjust the ribbon cable on a PowerType printer. (Job Sheet #29)

dd. Adjust the power supply voltage on a PowerType printer. (Job Sheet #30)

SERVICING AND REPAIRING LETTER-QUALITY PRINTERS
UNIT III

SUGGESTED ACTIVITIES

A. Provide student with objective sheet.

B. Provide student with information and job sheets.

C. Make transparencies.

D. Discuss unit and specific objectives.

E. Have other available letter-quality printers available so you can compare their components and operational characteristics with the PowerType printer which is the subject of much of the information sheet in this unit and the subject of all the job sheets.

F. Have a PowerType printer available to demonstrate the procedures in the job sheets, and have another PowerType printer available to use for spare parts as students go through the job sheets.

G. Have the PowerType *User's Manual* and *Technical Manual* both available so students can reference them as required during the job sheets.

H. Demonstrate the variations in DIP switch settings, and how the WP and PM printing modes function with the PowerType.

I. Demonstrate to the class the use of BASIC when using the WP mode on the PowerType.

J. Discuss the utility programs in the PowerType *User's Manual* and their value in troubleshooting.

K. Give test.

CONTENTS OF THIS UNIT

A. Objective sheet

B. Information sheet

C. Transparency masters

1. TM 1 — PowerType Block Diagram
2. TM 2 — PowerType Control Block Diagram
3. TM 3 — PowerType DIP Switch Settings
4. TM 4 — PowerType Parallel Interface

CONTENTS OF THIS UNIT

5. TM 5 — PowerType Parallel Interface (Continued)
6. TM 6 — PowerType Serial Interface
7. TM 7 — PowerType Serial Interface (Continued)
8. TM 8 — Control Logic Board CN3 Pinout
9. TM 9 — Control Logic Board CN1 Pinout
10. TM 10 — Control Logic Board CN1 Pinout (Continued)
11. TM 11 — Control Drive Board CN3 and CN4 Pinouts
12. TM 12 — Control Logic Board to Control Drive Board Connectors
13. TM 13 — Control Logic, Drive Board, and Power Supply Connectors

D. Job sheets

1. Job Sheet #1 — Unpack, Set Up, and Run a Printer Self Test on a PowerType Printer
2. Job Sheet #2 — Remove and Replace the Upper Case, Cover Open Detector, and Printer Cover on a PowerType Printer
3. Job Sheet #3 — Remove and Replace the Control Panel Board on a PowerType Printer
4. Job Sheet #4 — Remove and Replace the Control Drive Board on a PowerType Printer
5. Job Sheet #5 — Remove and Replace the Control Logic Board on a PowerType Printer
6. Job Sheet #6 — Remove and Replace the Power Regulator Unit and the Power Supply Unit on a PowerType Printer
7. Job Sheet #7 — Remove and Replace the Printer Mechanism on a PowerType Printer
8. Job Sheet #8 — Remove and Replace the Paper Feed Assembly on a PowerType Printer
9. Job Sheet #9 — Remove and Replace the Carriage Motor Assembly on a PowerType Printer
10. Job Sheet #10 — Remove and Replace the Ribbon Feed Motor Assembly on a PowerType Printer

CONTENTS OF THIS UNIT

11. Job Sheet #11 — Remove and Replace the Hammer Unit on a PowerType Printer

12. Job Sheet #12 — Remove and Replace the Carriage Stay on a PowerType Printer

13. Job Sheet #13 — Remove and Replace the Carriage Assembly on a PowerType Printer

14. Job Sheet #14 — Remove and Replace the Platen Cover and Platen Assembly on a PowerType Printer

15. Job Sheet #15 — Remove and Replace the Paper Chute on a PowerType Printer

16. Job Sheet #16 — Remove and Replace the Ball Roller Assembly on a PowerType Printer

17. Job Sheet #17 — Remove and Replace the Terminal Board on a PowerType Printer

18. Job Sheet #18 — Remove and Replace the Printwheel Home Position Detector on a PowerType Printer

19. Job Sheet #19 — Remove and Replace the Carriage Home Position Detector on a PowerType Printer

20. Job Sheet #20 — Remove and Replace the Right End Detector on a PowerType Printer

21. Job Sheet #21 — Remove and Replace the Ribbon End Detector on a PowerType Printer

22. Job Sheet #22 — Remove and Replace the Primary and Secondary Fuses on a PowerType Printer

23. Job Sheet #23 — Make a Mutual Adjustment of the Hammer and Printwheel on a PowerType Printer

24. Job Sheet #24 — Make a Position Adjustment of the Printwheel Home Position Detector on a PowerType Printer

25. Job Sheet #25 — Adjust the Platen Position, Idler Gear Backlash, and Paper Pressure/Platen Gap on a PowerType Printer

26. Job Sheet #26 — Adjust the Timing Belt Tension on a PowerType Printer

27. Job Sheet #27 — Adjust the Carriage Home Position Detector on a PowerType Printer

28. Job Sheet #28 — Adjust the Carriage Right End Detector on a PowerType Printer

29. Job Sheet #29 — Adjust the Ribbon Cable on a PowerType Printer

CONTENTS OF THIS UNIT

30. Job Sheet #30 — Adjust the Power Supply Voltage on a PowerType Printer

E. Test

F. Answers to test

REFERENCES USED IN DEVELOPING THIS UNIT

A. *Daisywheel Printer PowerType Technical Manual.* Irvine, CA 91714: Star Micronics, Inc., 1984.

B. *PowerType Daisywheel Users Manual.* Irvine, CA 91714: Star Micronics, Inc., 1984.

SERVICING AND REPAIRING LETTER-QUALITY PRINTERS
UNIT III

INFORMATION SHEET

I. **Terms and definitions**

   A. CN — A schematic or block diagram notation for a connector

   B. CPI (characters per inch) — The measurement of the density of characters in a horizontal line of print

   C. Pitch — Another method of measuring the density of characters in a horizontal line of print

   D. Pica type — Printing at a pitch of 10 CPI which gives clear, easy-to-read letters and is a popular pitch for business letters and reports

   E. Elite type — Printing at a pitch of 12 CPI which puts more words on a page and is popular for business uses and for conserving space in long reports

   F. Condensed type — Printing at a pitch of 15 CPI which is a popular pitch for tables and charts where much information has to go into limited space

   G. Proportional pitch — A pitch that balances out white space between wide letters such as "M" and narrow letters such as "I" to make a printed page look better

   H. CPS (characters per second) — A measurement of how fast a printer prints

   I. LPI (lines per inch) — The measurement of the number of lines in a vertical inch of space

   J. Single space — Printing at 8 LPI

   K. Space and a half — Printing at 6 LPI

   L. Double space — Printing at 4 LPI

   M. Triple space — Printing at 2 LPI

II. **Major components of a PowerType letter-quality printer** (Transparencies 1 and 2)

   A. Printer mechanism

   B. Control drive board

   C. Control logic board

   D. Control panel board

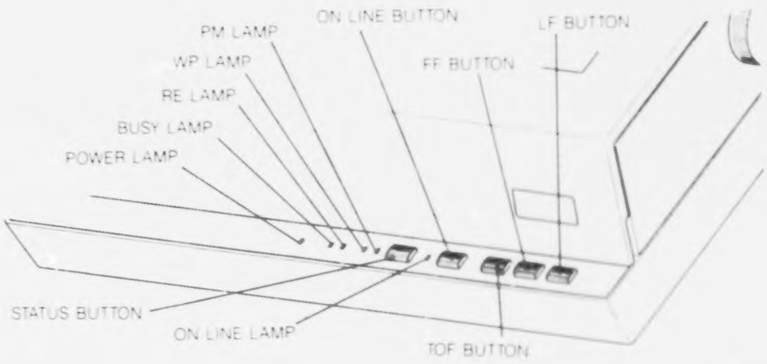
INFORMATION SHEET

E. Power regulator unit

(NOTE: The PowerType letter-quality printer has been selected as an excellent printer to demonstrate components and service procedures common to many letter-quality printers. The PowerType is manufactured by Star Micronics, Inc., and materials in both this information sheet and the job sheets that follow have been adapted from materials published by Star Micronics, Inc., and are reprinted with permission.)

III. **PowerType control buttons and display lamps and their functions** (Figure 1)

FIGURE 1



Courtesy Star Micronics, Inc.

A. LF (line feed) button — Feeds paper continuously when pressed while printer is in off line status, and activates the printer self test if pressed just as power is turned on

B. FF (form feed) button — Feeds paper when pressed while printer is off line

C. TOF (top of form) button — Sets the page start position and causes a buzzer to ring when it is pressed

D. ON LINE button — Controls the on line/off line status of the printer and is ON LINE when power is turned ON

E. STATUS button — Controls the WP (word processing) or PM (Star printer) modes for controlling printing formats

F. ON LINE lamp — Lights a green LED when printer is in an ON LINE status

INFORMATION SHEET

G. PM lamp — Lights a green LED when printer is in the PM mode

H. WP lamp — Lights a green LED when the printer is in the WP mode

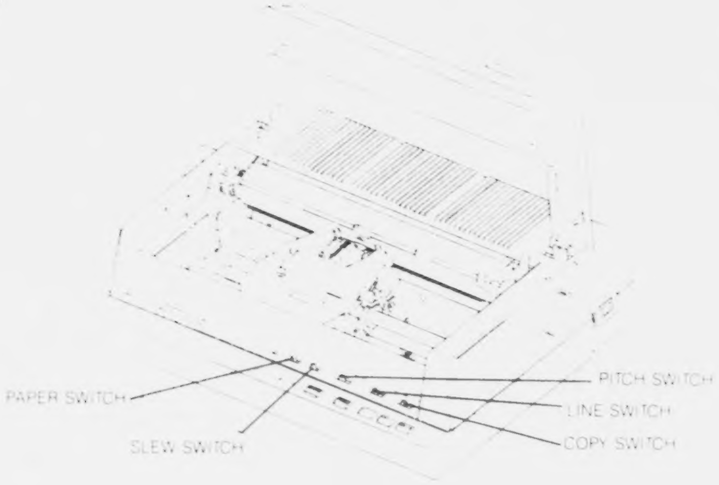
I. RE lamp — Lights a red LED when the ink ribbon has run out

J. BUSY lamp — Lights a green LED when the printer cannot receive information

K. POWER lamp — Lights a green LED to indicate printer power is ON

IV. **PowerType slide switches and their functions** (Figure 2)

FIGURE 2



Courtesy Star Micronics, Inc.

A. PAPER switch — Selects 11- or 12-inch paper length

B. SLEW switch — Specifies line feed according to a CR (carriage return) code sent from the host computer, and inputs only with no line feed on a CR code, and automatically feeds one line on a CR/LF code

C. PITCH switch — Used to show the spacing in columns per inch, and may be set to 10, 12, 15, or PS for proportional

D. LINE switch — Used to specify spaces between lines, and may be set at 3, 4, 6, or 8

E. COPY switch — Used to control printing pressure of the printwheel so when duplicate paper is used the pressure can be increased to heavy to compensate for the added paper thickness

INFORMATION SHEET

V. **Setting DIP switches on a PowerType printer** (Transparency 3)

A. DIP switch 1 controls the PowerType parallel interface, and most printers are shipped with DIP switch 1 set for operation

B. DIP switch 2 controls the PowerType serial interface, and the DIP switch functions should be checked if a serial interface is required for a host computer

C. Each of the DIP switches contains ten individual switches:

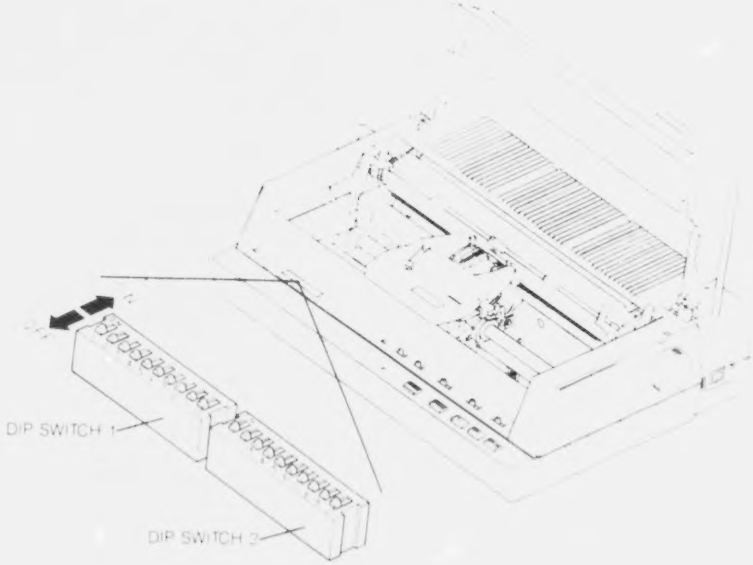
1. DIP switch 1 includes pins 1-1 through 1-10
2. DIP switch 2 includes pins 2-1 through 2-10

D. A pin is set to ON by pushing it towards the rear of the printer, while pushing the pin forward puts it in the OFF position

E. A ball-point pen with the tip retracted is a handy tool for setting the switch pins, but be sure to record the original pin settings before changing a pin

F. Make sure that both the host computer and the printer are OFF before setting pins on a DIP switch (Figure 3)

FIGURE 3



Courtesy Star Micronics, Inc.

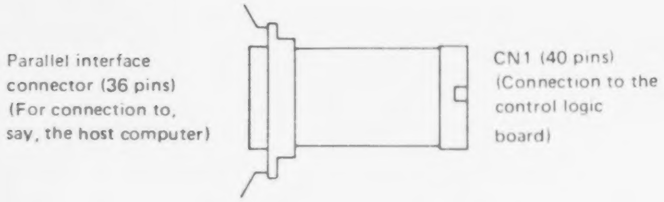
INFORMATION SHEET

VI. **The PowerType parallel interface connector** (Transparencies 4 and 5)

A. The parts standard for the parallel interface connector is a 57-30360 Amphenol product or equivalent

B. The connection for the host computer is a 36-pin connector, and the connection into CN1 of the control logic board is a 40-pin connector (Figure 4)

FIGURE 4


Parallel interface
connector (36 pins)
(For connection to,
say, the host computer)
CN1 (40 pins)
(Connection to the
control logic
board)

Courtesy Star Micronics, Inc.

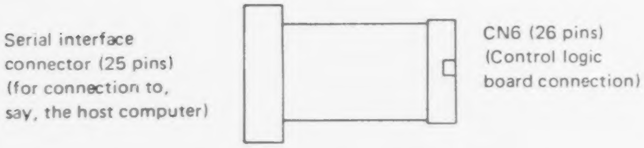
C. The parallel interfaces are based on TTL logic

VII. **The PowerType serial interface connector** (Transparencies 6 and 7)

A. The parts standard for the serial interface connector is a DB25P CANNON product or equivalent

B. The connection for the host computer is a 25-pin connector, and the connection into CN6 of the control logic board is a 26-pin connector (Figure 5)

FIGURE 5


Serial interface
connector (25 pins)
(for connection to,
say, the host computer)
CN6 (26 pins)
(Control logic
board connection)

Courtesy Star Micronics, Inc.

C. The RS-232C signal level is a −12V for mark and a +12V for space, and the current loop signal level is current ON for mark and current OFF for space

INFORMATION SHEET

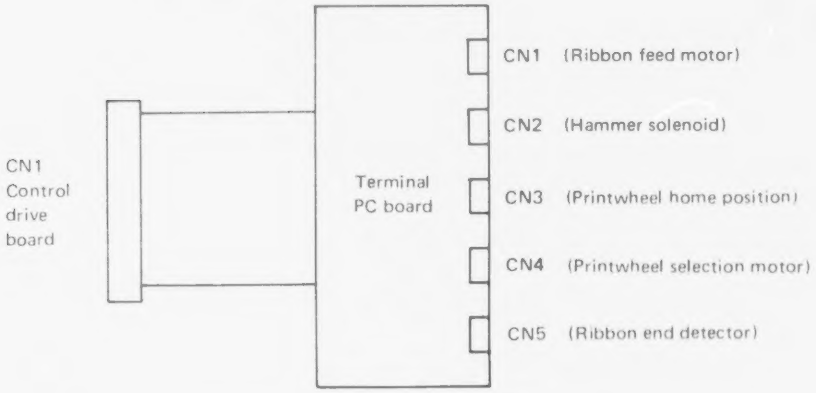
VIII. PowerType logic, drive, and power supply connectors

A. CN3 and CN4 are used for transmission and reception of signals between the printer mechanism and the control logic board (Transparency 8)

B. CN1, CN3, and CN4 are used for transmission and reception of drive signals between the printer mechanism and the control drive board (Transparencies 9, 10, and 11)

C. The control drive board connectors control the ribbon feed motor, the hammer solenoid, the printwheel home position, the printwheel selection motor, and the ribbon end detector through the terminal PC board (Figure 6)

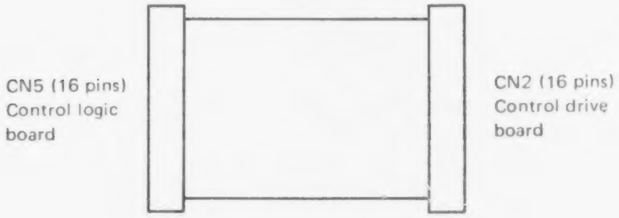
FIGURE 6


CN1
Control
drive
board
Terminal
PC board
CN1 (Ribbon feed motor)
CN2 (Hammer solenoid)
CN3 (Printwheel home position)
CN4 (Printwheel selection motor)
CN5 (Ribbon end detector)

Courtesy Star Micronics, Inc.

D. CN5 on the control logic board and CN2 on the control drive board are used for the transmission and reception of signals between the control logic board and the control drive board (Figure 7, and Transparency 12)

FIGURE 7


CN5 (16 pins)
Control logic
board
CN2 (16 pins)
Control drive
board

Courtesy Star Micronics, Inc.

INFORMATION SHEET

E. CN9 on the control board and CN6 on the control drive board provide the +5V power supply (Figure 8 and Transparency 13)

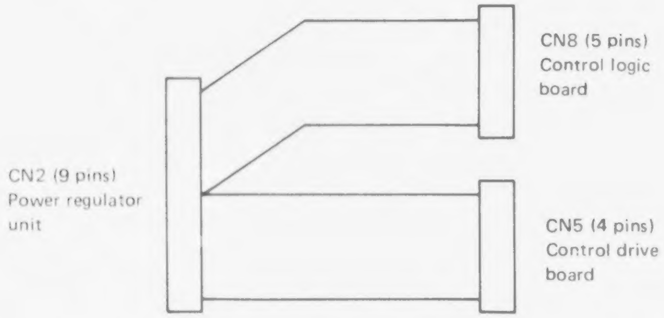
FIGURE 8

CN9 (3 pins)
Control logic
board
CN6 (3 pins)
Control drive
board

Courtesy Star Micronics, Inc.

F. CN2 on the power regulator unit, and CN8 on the control logic board, and CN5 on the control drive board provide the power supply from the power regulator unit to the control logic board and the control drive board (Figure 9 and Transparency 13)

FIGURE 9


CN8 (5 pins)
Control logic
board
CN2 (9 pins)
Power regulator
unit
CN5 (4 pins)
Control drive
board

Courtesy Star Micronics, Inc.

G. CN1 on the power regulator unit provides the power supply from the fuse board to the power regulator unit (Transparency 13)

(NOTE: Refer to Transparency 1 and to pinouts in Transparencies 8 through 13 when troubleshooting control problems.)

INFORMATION SHEET

IX. **Printing modes on the PowerType**

A. For the printer to respond properly to control codes, a status slide switch has to be set to select a printing mode

B. When using a word processing package, the printer must be set in a WP (word processing) mode

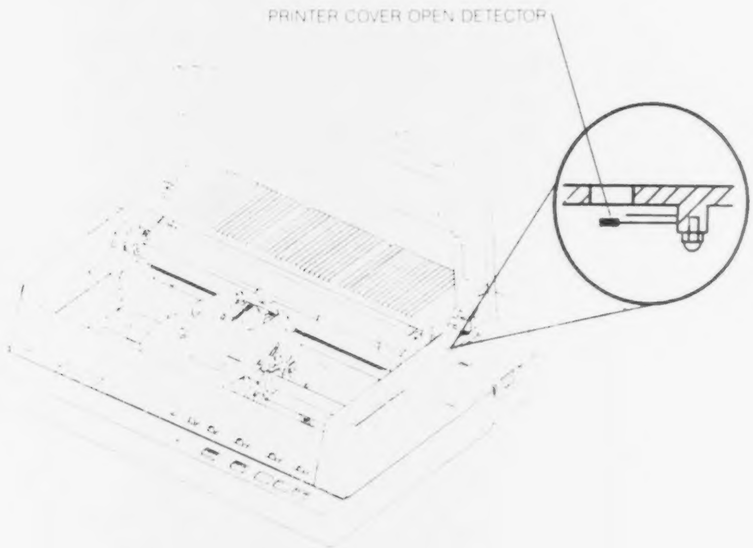
C. When using BASIC or another computer language, the printer must be set in a PM (Star printer) mode

(NOTE: These codes control printing style, horizontal and vertical formatting, graphics, and many other features, and anytime print mode problems are suspected, the technician should consult the *PowerType User's Manual,* and review the chapters dedicated to mode selection and control.)

X. **PowerType detection mechanisms and their functions**

A. Printer cover-open detector — Causes the ON LINE lamp to go out when the printer cover is open and the printer will not print until the cover is firmly closed and the ON LINE button pressed (Figure 10)

FIGURE 10



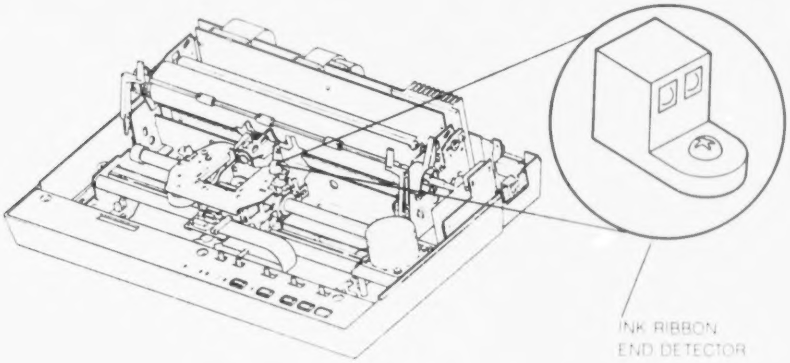
Courtesy Star Micronics, Inc.

INFORMATION SHEET

B. Ink ribbon end detector — Senses the aluminum foil strip at the end of a ribbon, causes the printer to beep and stop printing as the ON LINE lamp goes out and the RE lamp comes on (Figure 11)

(NOTE: Installation of a new ribbon will get the printer operating again, and this procedure is outlined in Job Sheet #1.)

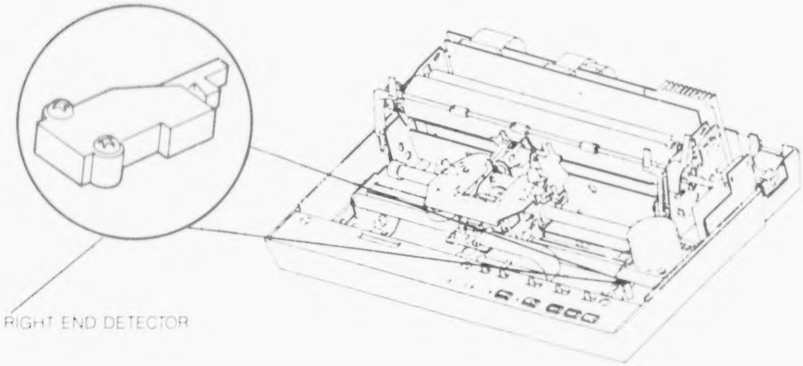
FIGURE 11



Courtesy Star Micronics, Inc.

C. Right end detector — Stops the printer before the print carriage overruns the maximum right end position so the printwheel will not be damaged (Figure 12)

FIGURE 12



Courtesy Star Micronics, Inc.

INFORMATION SHEET

XI. **PowerType alarms and their meanings**

A. Four short beep sounds in succession repeated three times indicates the end of the ribbon and time to install a new ribbon cartridge

B. A beep about ¼ second long is a BEL code that may indicate the end of a printout or a printwheel problem

(NOTE: Although BEL is the ASCII code for bell, there is no bell on the PowerType. Rather, it is a buzzer that beeps or buzzes depending on how you choose to define a beep or a buzz.)

C. A three second beep indicates a problem with the right end detector, but can also indicate general problems in CPU control functions

(NOTE: When the beep sounds while the carriage is at the right end, it usually means a detector problem, not a CPU problem.)

XII. **Steps in cleaning a PowerType printer** (Figure 13)

A. Turn the printer off and disconnect the power cord before cleaning inside the printer

B. Remove the interface connector from the printer, remove the platen knobs, and separate the upper case from the lower case by removing the seven screws, four at the back and three near the control panel

C. Lift the cover off, lay it carefully aside, and disconnect the cover open detector cable

D. Use a soft cloth or brush (or both) to thoroughly dust off the inner components, and be sure to clean dust and dirt from the ribbon guide and the carriage mechanism

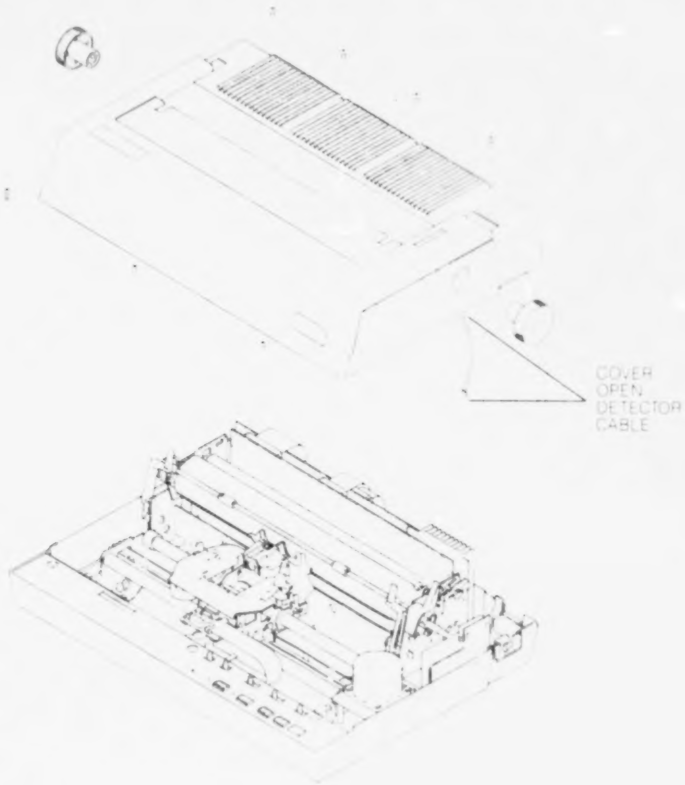
E. Reassemble the printer and run a printer self test

(NOTE: This periodic cleaning is about the only maintenance required for a PowerType except for changing a ribbon or a printwheel or replacing the system fuses, and those activities are covered in the job sheets.)

INFORMATION SHEET

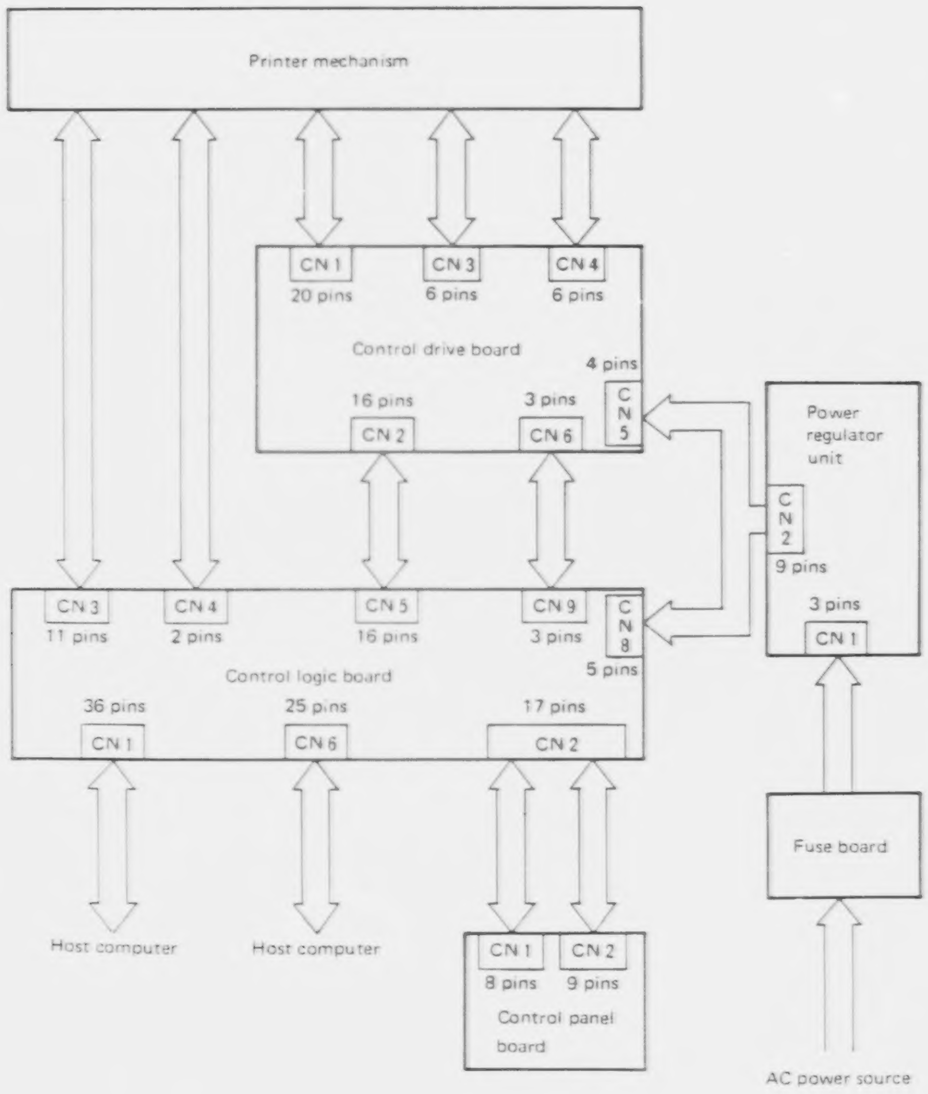
F. If the outside of the printer requires cleaning, use a damp cloth with alcohol, but be careful not to drip alcohol into the printer mechanism

FIGURE 13


COVER
OPEN
DETECTOR
CABLE

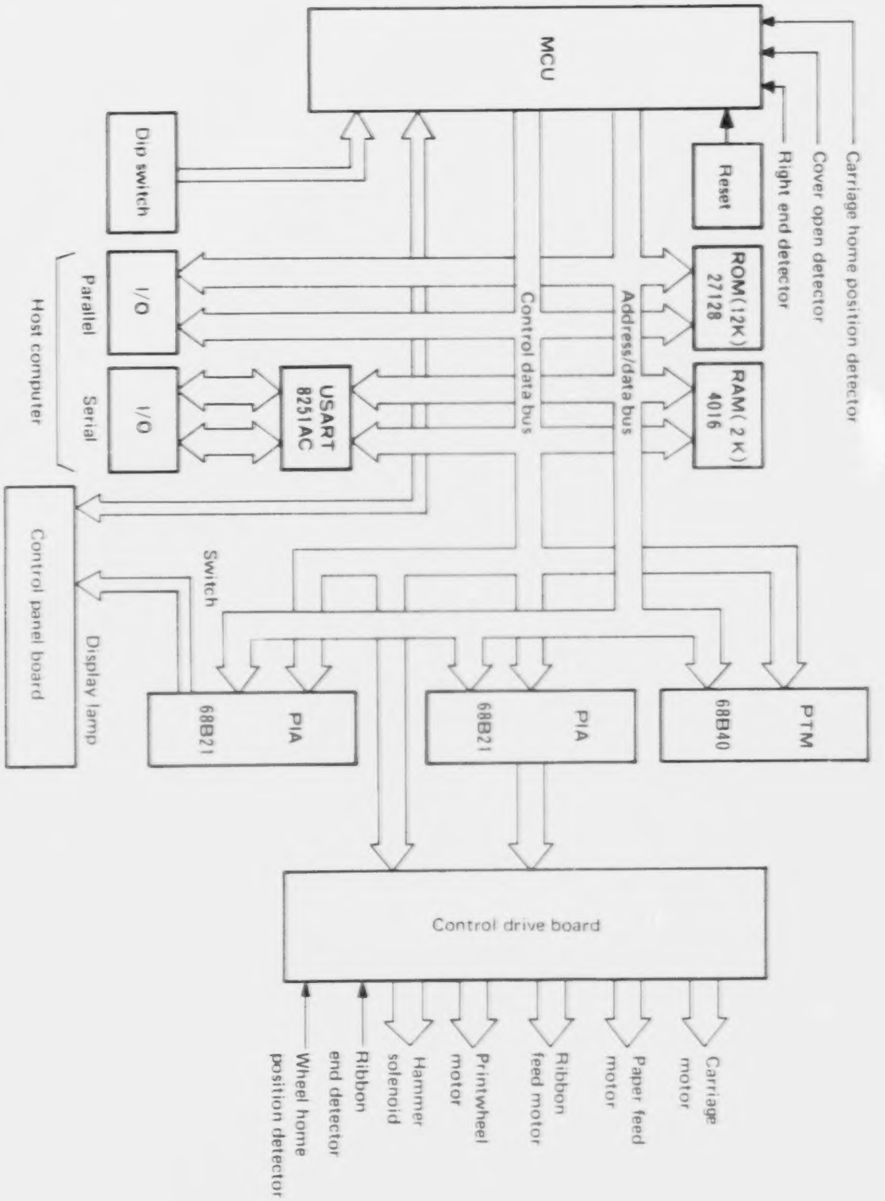
Courtesy Star Micronics, Inc.

PowerType Block Diagram


Printer mechanism
CN 1
20 pins
CN 3
6 pins
CN 4
6 pins
Control drive board
4 pins
CN5
16 pins
CN 2
3 pins
CN 6
Power regulator unit
CN2
9 pins
3 pins
CN 1
CN 3
11 pins
CN 4
2 pins
CN 5
16 pins
CN 9
3 pins
CN8
5 pins
Control logic board
36 pins
CN 1
25 pins
CN 6
17 pins
CN 2
Fuse board
Host computer
Host computer
CN 1
8 pins
CN 2
9 pins
Control panel board
AC power source

Courtesy Star Micronics, Inc.

PowerType Control Block Diagram


MCU
Carriage home position detector
Cover open detector
Right end detector
Reset
Dip switch
ROM (12K) 27128
RAM (2K) 4016
Control data bus
Address/data bus
I/O
Parallel
I/O
Serial
USART 8251AC
Host computer
Control panel board
Switch
Display lamp
PIA 68B21
PIA 68B21
PTM 68B40
Control drive board
Carriage motor
Paper feed motor
Ribbon feed motor
Printwheel motor
Hammer solenoid
Ribbon end detector
Wheel home position detector

Courtesy Star Micronics, Inc.

PowerType DIP Switch Settings

DIP Switch 1

Pin	ON	OFF	Setting*
1-1	Serial interface	Parallel interface	
1-2	Slide switch control	Slide switch and code control	
1-3	WP mode	PM mode	
1-4	Not used		
1-5	Select printwheel (see below)		
1-6			
1-7			
1-8	Not used		
1-9	Not used		
1-10	Not used		

DIP Switch 2

Pin	ON	OFF	Setting*
2-1	2 stop bits	1 stop bit	
2-2	7-bit data byte	8-bit data byte	
2-3	Parity checked	No parity	
2-4	Set handshaking protocols (see below)		
2-5			
2-6	Odd parity	Even parity	
2-7	Select bit rate (see below)		
2-8			
2-9			
2-10	Not used		

Select Printwheel

Printwheel	1-5	1-6	1-7
ASCII 96 printwheel	OFF	OFF	OFF
Word processor printwheels	OFF	OFF	ON
Type A* international printwheels	OFF	ON	OFF
Type B* international printwheels	OFF	ON	ON
Type C international printwheels	ON	OFF	OFF
Proportional word processor printwheels	ON	ON	OFF
Download printwheels	ON	ON	ON

*for future wheels

Set Handshaking Protocols

Protocol	2-4	2-5
Serial busy, 1 byte mode	OFF	OFF
Serial busy, 1 block mode	ON	OFF
ACK mode	OFF	ON
XON/XOFF mode	ON	ON

Set Bit Rate

Bit Rate	2-7	2-8	2-9
150 bps	OFF	OFF	OFF
300 bps	OFF	OFF	ON
600 bps	OFF	ON	OFF
1,200 bps	OFF	ON	ON
2,400 bps	ON	OFF	OFF
4,800 bps	ON	OFF	ON
9,600 bps	ON	ON	OFF
19,200 bps	ON	ON	ON

*Use the "Setting" column to record the way the switches are set in your printer

Courtesy Star Micronics, Inc.

TM 3

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PowerType Parallel Interface

Parallel interface connector pin No.	Signal name	I/O Classification	Description	CN1 pin No.
1	$\overline{\text{STROBE}}$	IN	• Synchronous data read signal • Normally this is high. It is latched at the leading edge of the signal. • A pulse width of at least 0.5 μsec is required.	1
2	DATA 1	IN	• Each signal represents the data contained from bit 1 to bit 8. • Data 1: high Data 0: low • At least 0.5 μsec is required for each bit from the leading edge of the $\overline{\text{STROBE}}$ signal.	3
3	DATA 2			5
4	DATA 3			7
5	DATA 4			9
6	DATA 5			11
7	DATA 6			13
8	DATA 7			15
9	DATA 8			17
10	$\overline{\text{ACK}}$	OUT	• This pulse issued after storage of the data signals in the buffer, calls for transmission of the data signals. • This is normally high, and is about 9 μsec in width.	19
11	BUSY	OUT	• Input of data signals to the printer is inhibited when this is high.	21
12	PAPER OUT	OUT	• This signal is normally low, but goes high when there is no paper. However, it is maintained low then.	23
13	SELECTED	OUT	• When high, this signal indicates that the printer is in the online status.	25
14	NC (TTL LOW LEVEL)	IN	• Not used	27

Courtesy Star Micronics, Inc.

PowerType Parallel Interface

(Continued)

Parallel interface connector pin No.	Signal name	I/O Classification	Description	CN1 pin No.
15	NC		• Not used	29
16	SIGNAL-GND		• GND level of the logic.	31
17	CHASSIS-GND		• Printer chassis GND level.	33
18	EXT. +5V	OUT	• Supply of +5V, max.50mA current from the printer to outside.	35
19	GND		• Twisted pair return signal GND level.	2
20				4
21				6
22				8
23				10
24				12
25				14
26				16
27				18
28				20
29				22
30				24
31	$\overline{\text{INPUT PRIME}}$	IN	• Normally this is high, but if it goes low, the printer enters the initial state. (This is the same as the power on status). • For the receiving terminal, a pulse width of 50 μsec is necessary.	26
32	$\overline{\text{ERROR}}$	OUT	• If the machine is in an abnormal condition, and printing is not possible, this signal is issued.	28
33	EXT. GND		• GND EXT. +5V	30
34	NC		• Not used.	32
35	NC		• Not used	34
36	NC		• Not used	36

Courtesy Star Micronics, Inc.

PowerType Serial Interface

Serial interface connector pin No.	Signal name	I/O Classification	Description	CN6 pin No.
1	F-GND		• Printer chassis GND level.	1
2	TXD	OUT	• Transmission line for transmission of serial data from the printer to the host computer. The mark status will prevail as long as there is no transmission of characters. • If the data is "0", it will represent a space. If it is "1", it will represent a mark.	3
3	RXD	IN	• Transmission line for transmission of serial data from the host computer to the printer. The mark level will prevail as long as there is no transmission of characters. • If the data is "0", it will represent a space. If it is "1", it will represent a mark.	5
4	RTS	OUT	• Normally high level	7
5	CTS	IN	• If this signal is in the "space" level, the printer can receive data. • JP10 makes it possible to ignore this signal.	9
6	DSR	IN	• Normally ignored.	11
7	S-GND		• GND level of the logic.	13
8	DCD	IN	• Normally ignored.	15
9	TTY TXRDY		• Return signal corresponding to TXD 20mA current loop output signal.	17
10	TTY TXD	OUT	• TXD 20mA current loop output signal.	19

Courtesy Star Micronics, Inc.

PowerType Serial Interface

(Continued)

Serial interface connector pin No.	Signal name	I/O Classification	Description	CN6 pin No.
11	REV-CH	OUT	• This is used when data is transmitted in the SERIAL BUSY mode. If in the "space" level, the signal indicates transmission request; if in the "mark" level, it indicates transmission disable.	21
12	NC		• Not used	23
13	S-GND		• GND level of the logic.	25
14	NC		• Not used	2
15	NC		• Not used	4
16	NC		• Not used	6
17	TTY TXRDY		• Return signal corresponding to TXD 20mA current loop output signal.	8
18	TTY RXRDY		• Return signal corresponding to RXD 20mA current loop input signal.	10
19	TTY RXD	IN	• RXD 20mA current loop input signal.	12
20	DTR	OUT	• Normally high level	14
21	NC		• Not used	16
22	NC		• Not used	18
23	TTY RXRDY		• Return signal corresponding to RXD 20mA current loop input signal.	20
24	TTY TXD	OUT	• TXD 20mA current loop output signal.	22
25	TTY RXD	IN	• RXD 20mA current loop input signal.	24

Courtesy Star Micronics, Inc.

Control Logic Board CN3 Pinout

Pin No.	Signal Name	I/O Classification	Color of line	Description
1	NC			Not used
2	NC			Not used
3	CR LED (+)		Violet	LED power source (+5V) for the photo coupler detecting carriage home position
4	CR TR (+)		Light blue	Transistor power source (+5V) for the photo coupler detecting carriage home position
5	CR LED (−)		Orange	LED GND for the photo coupler detecting carriage home position
6	CR TR (−)	IN	Red	Carriage home position detecting signal
7	NC			Not used
8	$\overline{\text{RED SW(−}}$)		Brown	GND of the right end detection switch
9	$\overline{\text{RED SW(+}}$)	IN	Yellow	Right end detection signal
10	NC			Not used
11	NC			Not used

Control Logic Board CN4 Pinout

Pin No.	Signal name	I/O Classification	Color	Description
1	$\overline{\text{COD SW(+}}$)	IN	White	Cover open detection signal
2	$\overline{\text{COD SW(−}}$)		Black	Cover open switch GND

Courtesy Star Micronics, Inc.

Control Logic Board CN3 Pinout

Pin No.	Signal Name	I/O Classification	Color of line	Description
1	NC			Not used
2	NC			Not used
3	CR LED (+)		Violet	LED power source (+5V) for the photo coupler detecting carriage home position
4	CR TR (+)		Light blue	Transistor power source (+5V) for the photo coupler detecting carriage home position
5	CR LED (−)		Orange	LED GND for the photo coupler detecting carriage home position
6	CR TR (−)	IN	Red	Carriage home position detecting signal
7	NC			Not used
8	$\overline{\text{RED SW}(-)}$		Brown	GND of the right end detection switch
9	$\overline{\text{RED SW}(+)}$	IN	Yellow	Right end detection signal
10	NC			Not used
11	NC			Not used

Control Logic Board CN4 Pinout

Pin No.	Signal name	I/O Classification	Color	Description
1	$\overline{\text{COD SW}(+)}$	IN	White	Cover open detection signal
2	$\overline{\text{COD SW}(-)}$		Black	Cover open switch GND

Courtesy Star Micronics, Inc.

Control Drive Board CN1 Pinout

Control drive board CN1 pin No.	Signal name	I/O Classification	Color of line	Use	Terminal board connector pin No.
1	RFM-CMN1	OUT	Black	• Ribbon feed motor A phase drive power source	CN1-1
2	RFM-CMN2	OUT	Black	• Ribbon feed motor B phase drive power source	CN1-2
3	RFMϕB	OUT	Red	• Ribbon feed motor B phase	CN1-4
4	RFM$\overline{\phi B}$	OUT	Yellow	• Ribbon feed motor $\overline{B}$ phase	CN1-3
5	RFMϕA	OUT	Brown	• Ribbon feed motor A phase	CN1-6
6	RFM$\overline{\phi A}$	OUT	Orange	• Ribbon feed motor $\overline{A}$ phase	CN1-5
7	WH LED (−)		Black	• GND of photo coupler LED used in printwheel home detection	CN3-1
8	WH CMN	OUT	White	• Power source for photo coupler LED used in printwheel home position detection	CN3-3
			Gray	•Transistor photo coupler LED used in printwheel home position detection	CN3-4
9	HAMMER (+)	OUT	Blue	• Hammer drive power source	CN2-1
10	WH TR (−)	IN	Yellow	• Printwheel home position detection signal	CN3-2
11	HAMMER(−)	OUT	Blue	• Hammer drive signal	CN2-2
12	WHMϕA	OUT	Orange	• Printwheel selection motor ϕ A phase	CN4-6

Courtesy Star Micronics, Inc.

Control Drive Board CN1 Pinout

(Continued)

Control drive board CN1 pin No.	Signal name	I/O Classification	Color of line	Use	Terminal board connector pin No.
13	$\text{WHM}\overline{\phi A}$	OUT	Blue	• Printwheel selection motor $\overline{\phi A}$ phase	CN4-5
14	$\text{WHM}\phi B$	OUT	Red	• Printwheel selection motor ϕB phase	CN4-4
15	$\text{WHM}\overline{\phi B}$	OUT	Yellow	• Printwheel selection motor $\overline{\phi B}$ phase	CN4-3
16	WHM-CMN1	OUT	Black	• Printwheel selection motor B phase drive power source	CN4-2
17	WHM-CMN2	OUT	White	• Printwheel selection motor A phase drive power source	CN4-1
18	RB CMN	OUT	Red	• Power source for ribbon end detection photo coupler LED transistor	CN5-2
19	RB LED		Black	• GND for ribbon end detection photo coupler LED	CN5-3
20	RB TR(−)	IN	White	• Ribbon end detection signal	CN5-1

Courtesy Star Micronics, Inc.

Control Drive Board CN3 and CN4 Pinouts

CN3

Pin No.	Signal name	Color of line	Use
1	CRM-CMN1	White	Carriage motor A phase drive power source
2	CRM-CMN2	Black	Carriage motor B phase drive power source
3	CRM$\overline{\phi B}$	White/Red	Carriage motor $\overline{B}$ phase
4	CRMϕB	Red	Carriage motor B phase
5	CRM$\overline{\phi A}$	Blue	Carriage motor $\overline{A}$ phase
6	CRMϕA	White/Blue	Carriage motor A phase

CN4

Pin No.	Signal name	Color of line	Use
1	LFM-CMN1	Black	Paper feed motor A phase drive power source
2	LFM-CMN2	Black	Paper feed motor B phase drive power source
3	LFM$\overline{\phi B}$	Yellow	Paper feed motor $\overline{B}$ phase
4	LFMϕB	Red	Paper feed motor B phase
5	LFM$\overline{\phi A}$	Orange	Paper feed motor $\overline{A}$ phase
6	LFMϕA	Brown	Paper feed motor A phase

Courtesy Star Micronics, Inc.

Control Logic Board to Control Drive Board Connectors

CN5 to CN2

CN5 pin No.	Signal name	I/O Classification	Use	CN2 pin No.
1	WHEEL HP	IN	• Printwheel home position detection signal	1
2	RIBBON END	IN	• Ribbon end home detection signal	2
3	SC	OUT	• Out-of-control run detection signal	3
4	CR-CMN	OUT	• Common line for carriage motor A and B phase	4
5	CRφA	OUT	• Carriage motor A phase control	5
6	CRφB	OUT	• Carriage motor B phase control	6
7	LF-CMN	OUT	• Common line for paper feed motor A and B phase	7
8	LFφA	OUT	• Paper feed motor A phase control	8
9	LFφB	OUT	• Paper feed motor B phase control	9
10	RB-CMN	OUT	• Common line for ribbon feed motor A and B phases	10
11	RBφA	OUT	• Ribbon feed motor A phase control	11
12	RBφB	OUT	• Ribbon feed motor B phase control	12
13	WHφA	OUT	• Printwheel selection motor A phase control	13
14	WHφB	OUT	• Printwheel selection motor B phase control	14
15	WH-CMN	OUT	• Common line for printwheel selection motor A and B phases	15
16	HAMMER	OUT	• Hammer control	16

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Control Logic, Drive Board, and Power Supply Connectors

Control Logic Board CN9 to Control Drive Board CN6

CN9 pin No.	Signal name	Color of line	Use	CN6 pin No.
1	+5V	Brown	• +5V	1
2	GND	Red	• Logic grounding	2
3	NC		• Not used	3

Power Regulator Unit CN2 to Control Logic Board CN8 and Control Drive Board CN5

CN2 pin No.	Signal name	I/O classification	Color of line	Use	CN8 CN5 pin No.
3	+5V	OUT	Orange	• +5V	CN8-1
4	0V		Yellow	• Grounding for logic	CN8-2
2	+12V	OUT	Red	• +12V	CN8-3
8	−12V	OUT	Gray	• −12V	CN8-4
9	NC		White	• Not used	CN8-5
1	VM	OUT	Brown	• VM (motor solenoid power source)	CN5-1
5	VM	OUT	Pink	• VM (motor solenoid power source)	CN5-2
7	M-GND		Violet	• VM grounding	CN5-3
8	M-GND		Blue	• VM grounding	CN5-4

Power Regulator Unit CN1

CN1 pin No.	Signal name	Color of line	Use
1	AC (N)	White	• AC power (N)
2	NC		• Not used
3	AC (L)	Black	• AC power (L)

Courtesy Star Micronics, Inc.

SERVICING AND REPAIRING LETTER-QUALITY PRINTERS
UNIT III

JOB SHEET #1 — UNPACK, SET UP, AND RUN A PRINTER SELF TEST ON A POWERTYPE PRINTER

A. Tools and equipment

1. Printer as selected by instructor
2. User's manual
3. Hand tools
4. Supply of single sheet and sprocket-feed paper
5. Ink ribbon cartridge, platen knobs, printwheel, spare fuse, and power cord (original equipment)

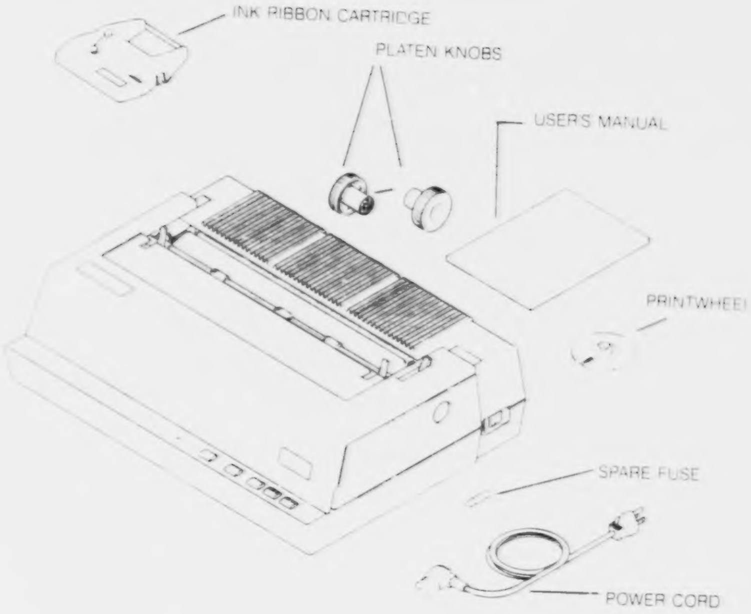
B. Procedure for unpacking and setting up

(NOTE: The procedures and illustrations in this job sheet are adapted from materials copyrighted © 1984 by Star Micronics, Inc., and are reprinted with permission.)

1. Sign on your troubleshooting log, and be sure to save your log for future job sheets
2. Place the shipping box upright on a clean work area
3. Open the box carefully and remove all unattached parts, and check for (Figure 1):
    a. The printer
    b. The User's Manual and a warranty card
    c. Two platen knobs
    d. An ink ribbon cartridge
    e. A power cord
    f. A spare fuse
    g. A printwheel

JOB SHEET #1

FIGURE 1

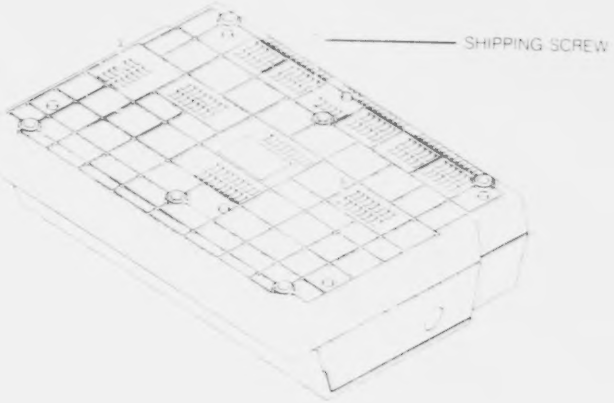

INK RIBBON CARTRIDGE
PLATEN KNOBS
USER'S MANUAL
PRINTWHEEL
SPARE FUSE
POWER CORD

4. Save the box and all packing material so it can be used again should the printer have to be shipped for repair

5. Take the printer out of the box and set it on a clean work area

6. Turn the printer upside down and remove the three shipping screws on the underside of the printer, and put the screws in a plastic bag and put them in the shipping box (Figure 2)

FIGURE 2


SHIPPING SCREW

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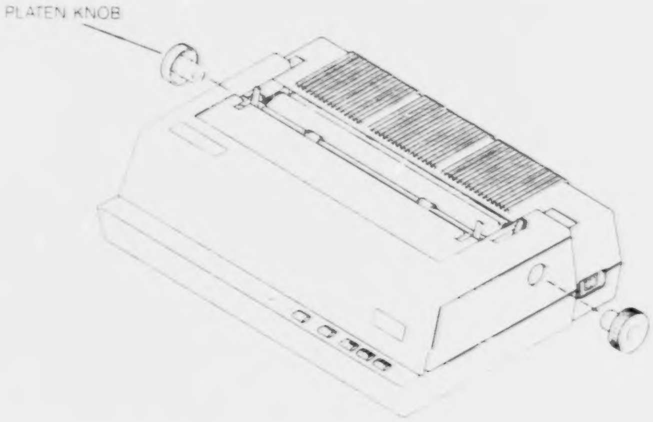
JOB SHEET #1

7. Turn the printer right side up, lift the printer cover, remove the cardboard and styrofoam packing from on top of the print carriage, and put it in the shipping box

8. Remove the two platen knobs from the small white box and place them firmly over the platen shaft ends at each end (Figure 3)

FIGURE 3



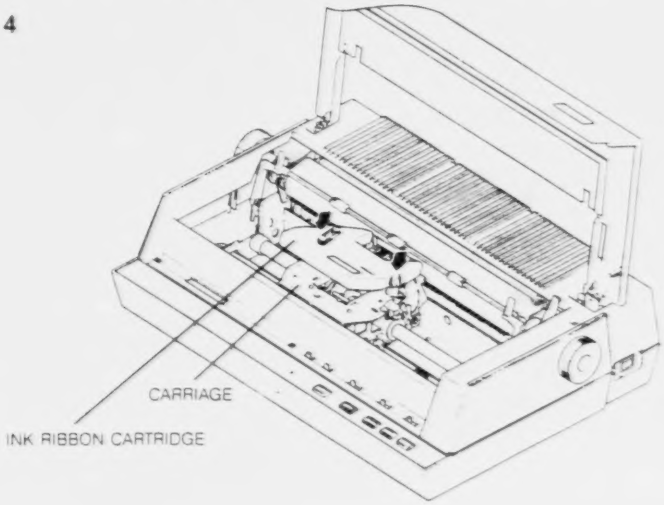
9. Remove the ribbon cartridge from its plastic bag and place it on the printer carriage

   (NOTE: If the ribbon is loose, twisted, or dirty, turn the blue knob with the arrow over it counterclockwise until a clean, tight ribbon appears.)

10. Raise the printer cover and orient the ribbon cartridge over the ribbon platform, making sure the ribbon itself clears the platen shield and does not snag

11. Press down lightly on the cartridge so that the clasps along the sides of the cartridge engage the slots in the sides of the cartridge (Figure 4)

FIGURE 4

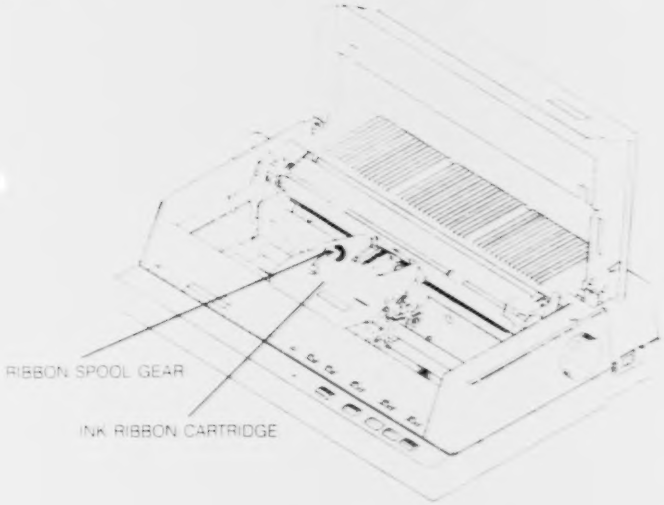


JOB SHEET #1

12. Rotate the ribbon spool gear counterclockwise to take up any slack in the ink ribbon (Figure 5)

    (NOTE: Replacing a ribbon cartridge requires unsnapping the clasps at each side of the cartridge, lifting it out, and putting a new cartridge in as was just outlined.)

    FIGURE 5



C. Procedure for mounting a printwheel (Figure 6)

1. Make sure the printer power is OFF, then raise the printer cover
2. Position the paper bail against the platen by moving the bail lever away from you
3. Gently slide the print carriage to the middle of its pathway
4. Remove the ink ribbon cartridge by pushing both cartridge clasps outward and lightly lifting from the bottom of the cartridge
5. Use the finger holds on both sides of the hammer head protector to pull it towards you so that the hammer head and printwheel (if there is one on the printer) slants toward you

JOB SHEET #1

6. Remove the old printwheel (if you are replacing a printwheel) by pulling firmly and evenly on the center knob with one hand while using the other hand to steady the hammer head protector

   (NOTE: After freeing the printwheel, take care that it doesn't pop off and hit something that could damage it.)

7. Align the center hole of the new printwheel with the wheel shaft, and make sure that the peripheral positioning hole fits the thin rectangular tip on the shaft

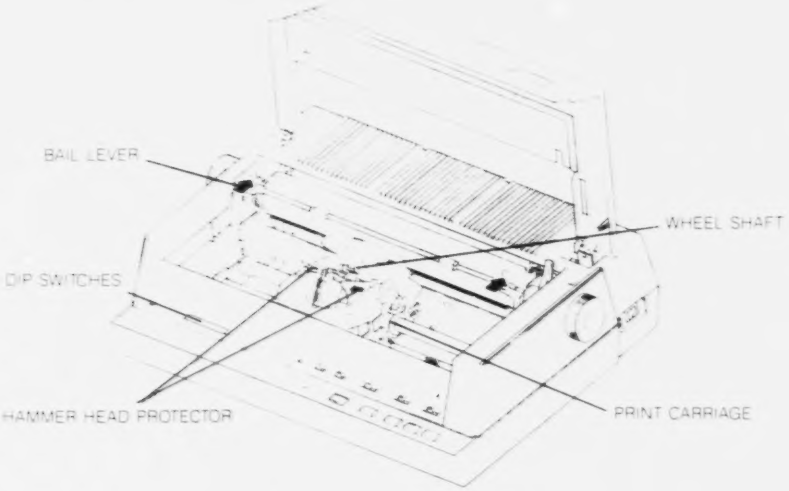
8. Press the wheel down firmly onto the shaft once it is properly aligned

9. Return the hammer head protector cover to its original position

10. Set DIP switches 1-5 through 1-7 according to the type of printwheel you have mounted

    (NOTE: The PowerType DIP switches come set for a standard ASCII 96 printwheel, so if you are using some other type, you will have to consult the *User's Manual* for the proper DIP switch settings.)

    FIGURE 6



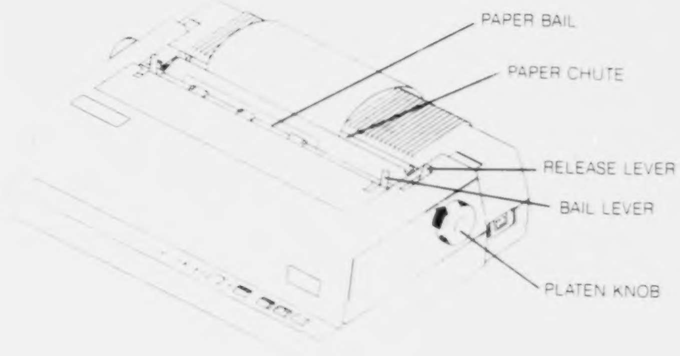
11. Remount the ink cartridge and close the printer cover

JOB SHEET #1

D. Procedure for inserting single-sheet paper (Figure 7)

1. Turn the power OFF
2. Raise the paper bail from the platen by moving the bail lever toward you
3. Move the release lever toward you to the open position
4. Slide the single sheet of paper into the space between the paper chute and the platen

FIGURE 7



5. Move the release lever back to the closed position
6. Rotate the platen knobs away from you and steady the single sheet as it feeds through the platen so that the sheet stays straight

   (NOTE: You may have to move the release lever to the open position to make a final adjustment on the paper.)

7. Return the paper bail against the platen

   (NOTE: When changing single-sheet paper types, check the PAPER switch on the slide switches to make sure it is at 11 or 12 inches to agree with the length of paper you are using, and if you're using multicopy paper, set the COPY switch setting to 2 or 3 to give more printing pressure, because a setting of 1 provides the least pressure and may not be sufficient with multicopy paper.)

JOB SHEET #1

8. Run a printer self test using the following procedure:

   a. Make sure printer is connected to a proper power source

   b. While holding down the LF button, turn the printer power ON

   c. Check to make sure there is paper in the printer because printing without paper could damage the platen

   d. Check the printout of the self test to make sure it duplicates the following (Figure 8):

   FIGURE 8

```
c!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~¬
c!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^¯`abcdefghijklmnopqrstuvwxyz{|}~¬
c!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^¯_`abcdefghijklmnopqrstuvwxyz{|}~¬
```

9. Check for problems of any kind, and if the printer is only feeding paper, but not printing, chances are the printer cover is not completely closed, so it should be checked

E. Procedure for mounting a tractor unit and paper separator on a PowerType printer (Figure 9)

   1. Move the paper bail away from the platen by pulling it toward you

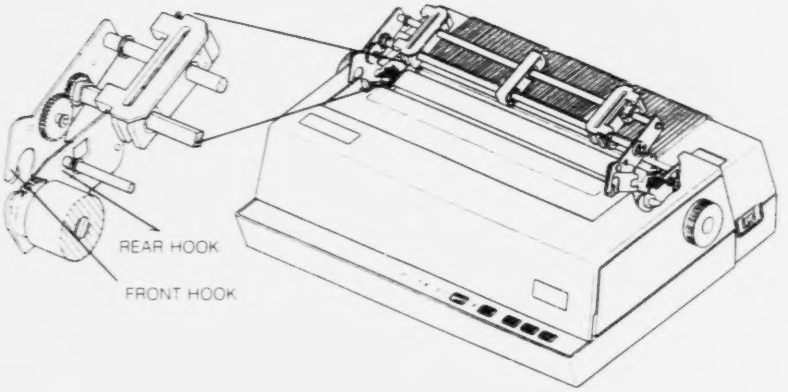
   2. Hold the tractor so that the gear assemblies are at the front left and the hook parts of the frame protrude toward you

   3. Lower the tractor onto the platen so that its rear hooks slide onto the stopper bars on the outside of the platen frame

JOB SHEET #1

4. Rotate the tractor on its rear hooks toward you, pressing down so that the front hooks firmly engage onto the nut-shaped bushings at the ends of the platen

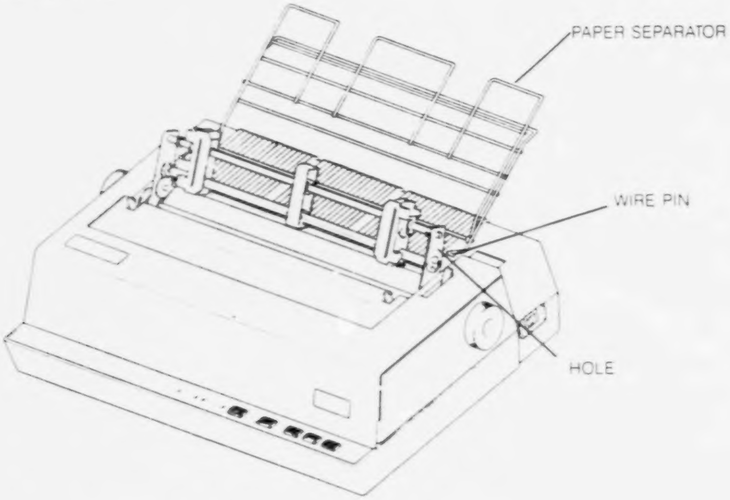
FIGURE 9


REAR HOOK
FRONT HOOK

5. Hold the paper separator so that the rack composed of three rectangles is on top and can swing toward you, then locate the wire pins on the left and right sides (Figure 10)

6. Insert the wire pins into the small holes in the sides of the tractor frame (Figure 10)

FIGURE 10


PAPER SEPARATOR
WIRE PIN
HOLE

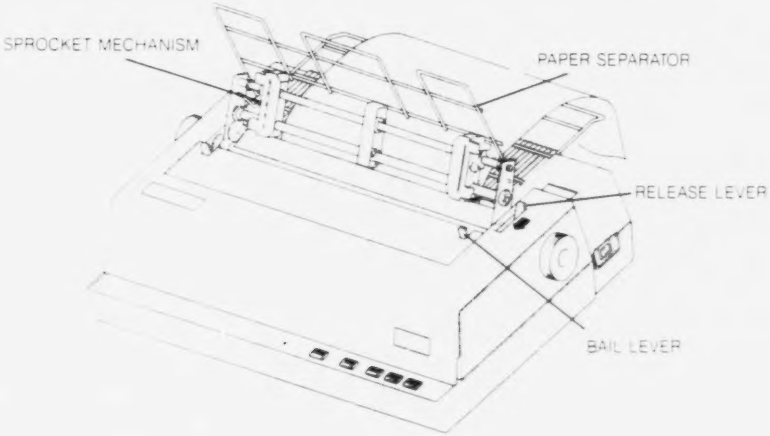
JOB SHEET #1

F. Procedure for loading sprocket-feed paper

1. Make sure the printer power is OFF, and move the paper bail away from the platen by pulling the paper bail lever toward you

2. Pull the release lever to the open position, then pull the paper separator upright (Figure 11)

FIGURE 11



3. Place a stack of sprocket-feed paper behind the printer and lift the top sheet of paper and insert it between the paper chute and platen from the rear of the platen cover

4. Push the sheet down into the chute so that it feeds around the platen and appears in front

5. Lower the paper separator

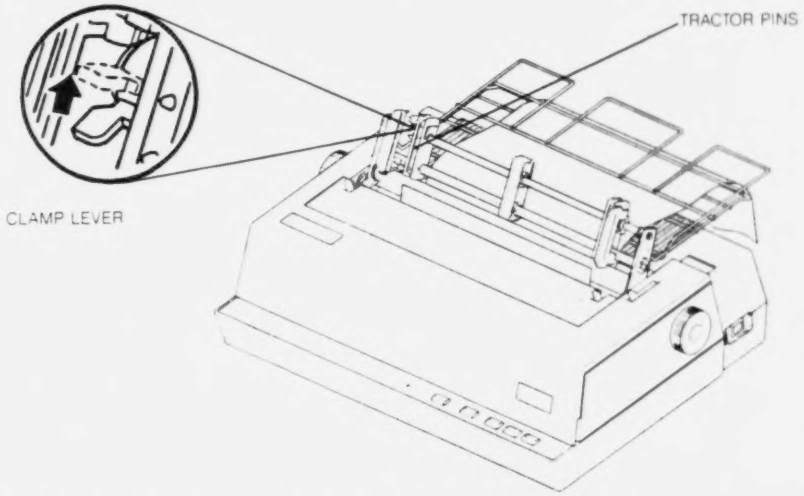
6. Flip the doors of the left and right sprocket mechanisms outward (Figure 11)

JOB SHEET #1

7. Locate the clamp levers on the outer side of each sprocket mechanism and push them upward

8. Adjust the sprocket mechanisms, sliding them left and right as needed to accommodate the width and position of the paper in the platen (Figure 12)

FIGURE 12

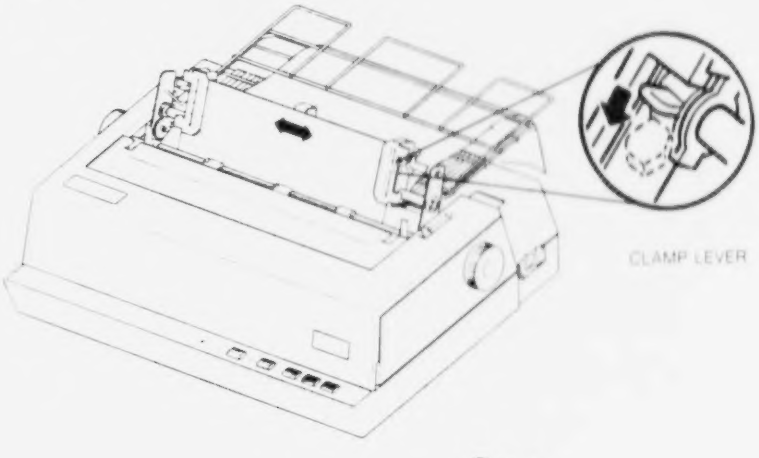


9. Align the sprocket holes in the paper with the tractor pins, and make sure that the paper is straight and that the holes you place onto the pins of the left tractor belt correspond to the same ones you place on the right tractor belt

10. Check final paper alignment, then close the sprocket mechanism doors and snap the clamp levers down (Figure 13)

11. Push the paper bail down and back into place, but do not move the release lever back to the closed position because it is used for platen/paper pressure on single-sheets only (Figure 13)

FIGURE 13



JOB SHEET #1

12. Check the setting of the PAPER and COPY slide switches to make sure the PAPER switch is set for 11 or 12-inch paper and that the COPY switch is set for 2 or 3 if you are using multicopy paper

13. Run a printer self test

    ☐ Have your instructor check your work, including the printer self test

14. Sign off your troubleshooting log

15. Clean up area and return tools and equipment to proper storage or prepare for next job sheet as directed by your instructor

JOB SHEET #1

Troubleshooting and Repair Log

Customer's Name ______________________ Invoice ______________

Date ______________ Equipment and Serial # ____________________

Complaint ____

____

Technician's Name & ID #	Date	Time On	Time Off	Work Performed	Replacement Parts Used & Inventory #

SERVICING AND REPAIRING LETTER-QUALITY PRINTERS
UNIT III

JOB SHEET #2 — REMOVE AND REPLACE THE UPPER CASE, COVER OPEN DETECTOR, AND PRINTER COVER ON A POWERTYPE PRINTER

A. Tools and equipment

1. Printer as selected by instructor
2. *Daisywheel Printer PowerType Technical Manual*
3. Hand tools
4. Troubleshooting log (from previous job sheet)

B. Procedure for unpacking and setting up (Figure 1)

(NOTE: The procedures and illustrations in this job sheet are adapted from materials copyrighted ©1984 by Star Micronics, Inc., and are reprinted with permission.)

1. Sign on your troubleshooting log, and save your log for use with the job sheets that follow
2. Turn the power switch OFF and remove the power cord from the back of the printer (Figure 1)
3. Pull out on the right and left platen knobs to remove them (Figure 1)
4. Remove the four M4 × 10 screws that secure the upper and lower cases
5. Open the printer cover and remove the three screws at the control panel
6. Lift up the upper case and separate the upper and lower cases
7. Remove the CN4 connector to the control logic board
8. Remove the connector to the cover open detector

   (NOTE: The figures that accompany this job sheet are on separate pages at the end of the job sheet so they can be better referenced for troubleshooting.)

JOB SHEET #2

☐ Have your instructor check your work

C. Procedure for removing the cover open detector (Figure 2)

1. Remove the M2.6 × 8 tapping screw that secures the cover open detector
2. Remove carefully one by one the lead lines secured by the SC-2 stop ring

☐ Have your instructor check your work

D. Procedure for removing the printer cover (Figure 3)

1. Remove the four M3 × 6 tapping screws that secure the cover holding plate
2. Lift the printer cover up to remove it

☐ Have your instructor check your work

E. Procedure for replacing printer cover, cover open detector, and upper case

1. Make sure all screws go back in the exact places from which they were removed
2. Reverse procedures for removal
3. Sign off your troubleshooting log

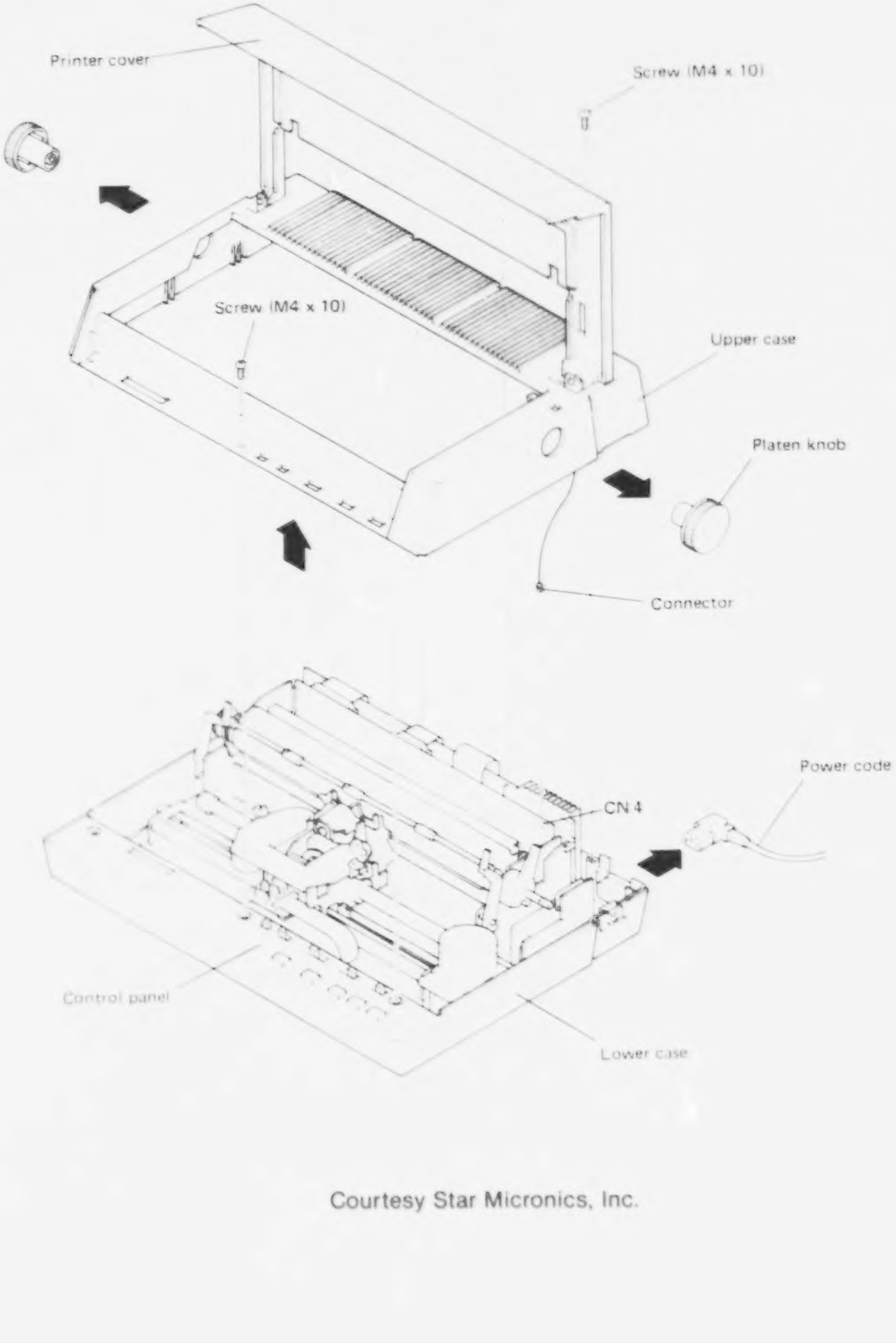
☐ Have your instructor check your work

4. Clean up area and return tools and equipment to proper storage, or prepare for next job sheet as directed by your instructor

(NOTE: The procedures outlined in Job Sheet #1 are required as the first step for many of the other procedures outlined in the following job sheets, so you may wish to refer to this job sheet when future references are made to removing the case, cover open detector, and printer cover.)

JOB SHEET #2

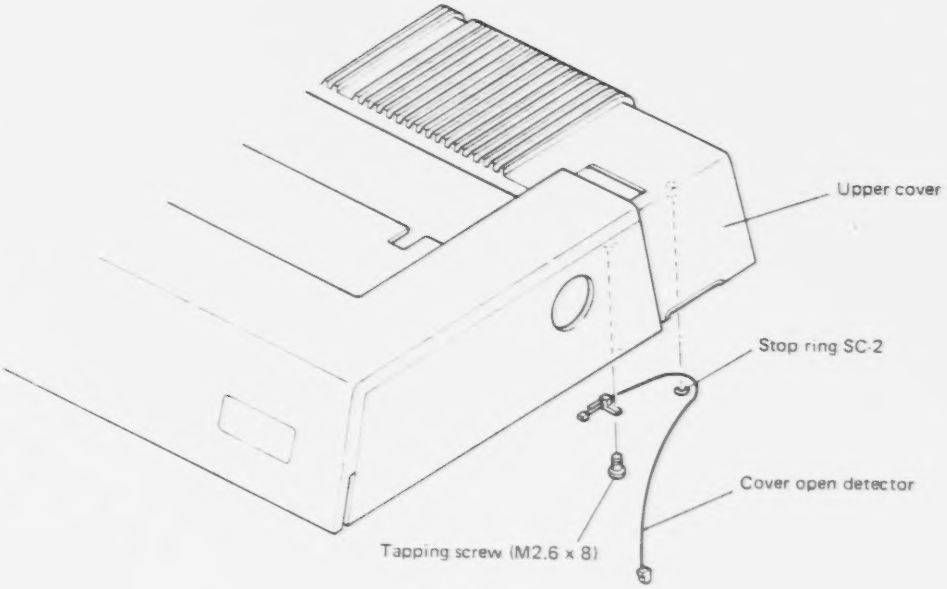
FIGURE 1


Printer cover
Screw (M4 x 10)
Screw (M4 x 10)
Upper case
Platen knob
Connector
CN 4
Power code
Control panel
Lower case

Courtesy Star Micronics, Inc.

JOB SHEET #2

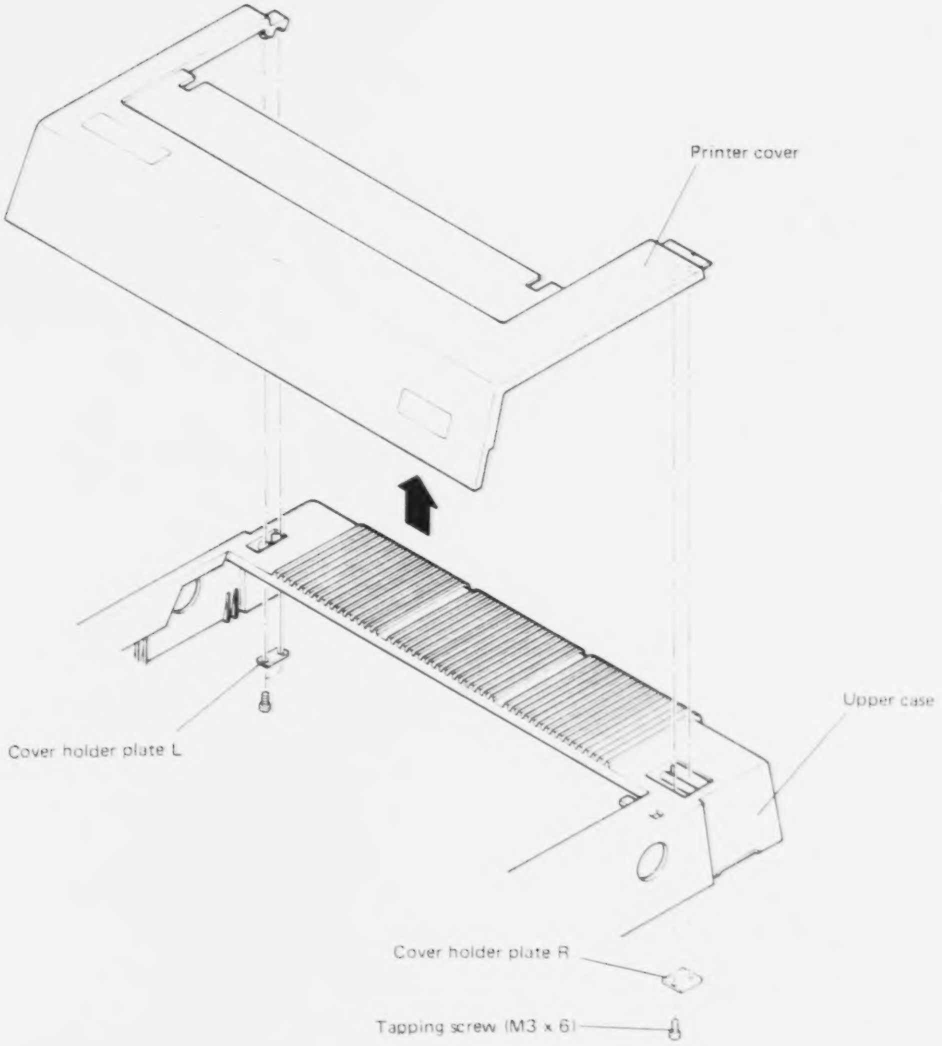
FIGURE 2


Upper cover
Stop ring SC-2
Cover open detector
Tapping screw (M2.6 x 8)

Courtesy Star Micronics, Inc.

JOB SHEET #2

FIGURE 3


Printer cover
Upper case
Cover holder plate L
Cover holder plate R
Tapping screw (M3 x 6)

Courtesy Star Micronics, Inc.

SERVICING AND REPAIRING LETTER-QUALITY PRINTERS
UNIT III

JOB SHEET #3 — REMOVE AND REPLACE THE CONTROL PANEL BOARD ON A POWERTYPE PRINTER

A. Tools and equipment

1. Printer as selected by instructor
2. *Daisywheel Printer PowerType Technical Manual*
3. Hand tools
4. DVOM
5. Dual-trace oscilloscope
6. Troubleshooting log (from previous job sheets)
7. Replacement parts as required

B. Procedure for removing the control panel board (Figure 1)

(NOTE: The procedures and illustrations in this job sheet are adapted from materials copyrighted © 1984 by Star Micronics, Inc., and are reprinted with permission.)

1. Sign on your troubleshooting log, and be sure to save your log for future job sheets

   (NOTE: The figures that accompany this job sheet are at the end of the job sheet so the separate illustrations can be used more easily in the troubleshooting routine.)

2. Turn the power switch OFF and remove the power cord from the back of the printer
3. Remove the upper case and cover as outlined in a previous job sheet
4. Remove connectors CN1 and CN2 from the control panel board
5. Remove the three M3 × 6 tapping screws that secure the control panel, and put the screws temporarily back in place or place them in order in a safe place
6. Remove the nine M3 × 8 tapping screws that secure the control panel board
7. Remove the five nets that cover the panel board's sliding switches
8. Lift the control panel and control panel board off very carefully, and do not apply heavy pressure or bend pins on any connectors

JOB SHEET #3

☐ Have your instructor check your work, and stop at this point to complete any troubleshooting activities that your instructor may assign

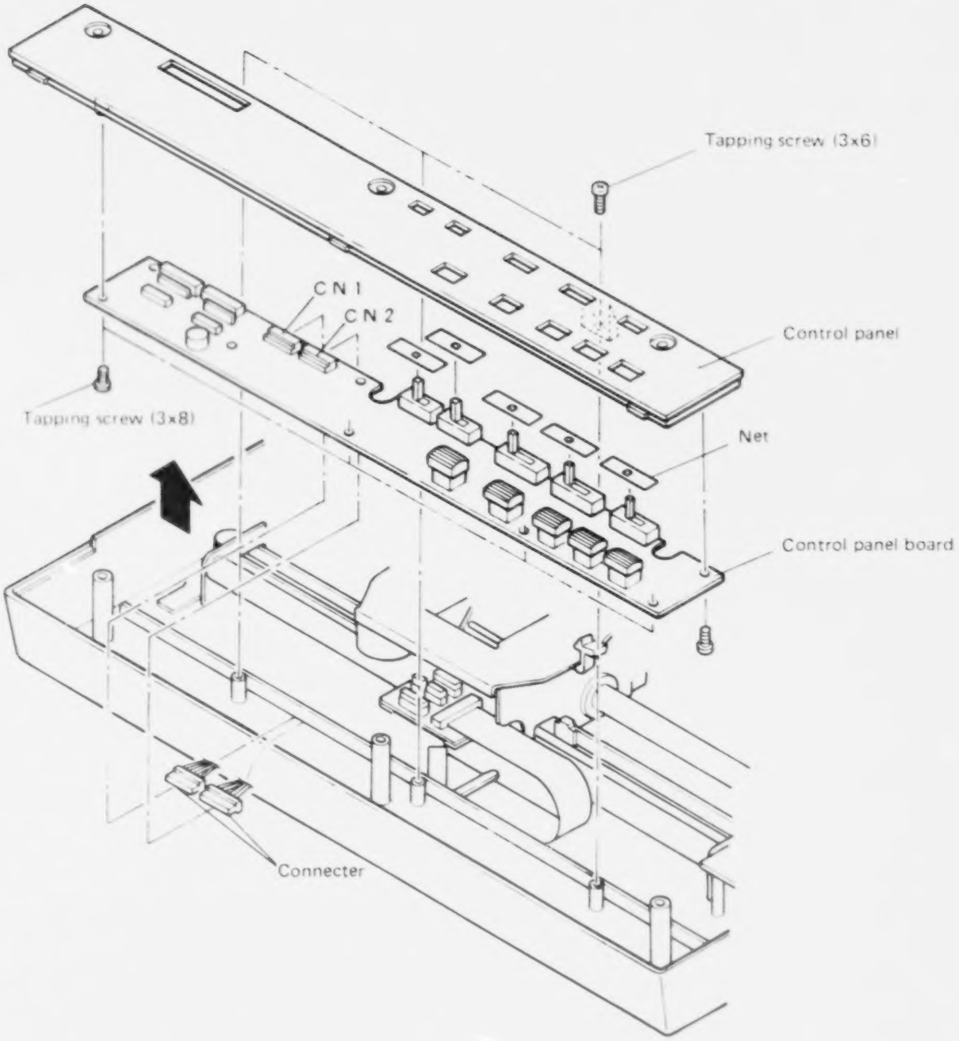
(NOTE: One of the prime rules of good troubleshooting is to disassemble no further than required to troubleshoot and repair a suspected malfunction, so at this point, suspected control panel board problems would normally be corrected.)

9. Replace the control panel board and control panel by reversing the removal procedure

10. Clean up area and return tools and equipment to proper storage, or prepare for next job sheet as directed by your instructor

JOB SHEET #3

FIGURE 1


Tapping screw (3x6)
C N 1
C N 2
Control panel
Tapping screw (3x8)
Net
Control panel board
Connecter

Courtesy Star Micronics, Inc.

SERVICING AND REPAIRING LETTER-QUALITY PRINTERS
UNIT III

JOB SHEET #4 — REMOVE AND REPLACE THE CONTROL DRIVE BOARD ON A POWERTYPE PRINTER

A. Tools and equipment

1. Printer as selected by instructor
2. *Daisywheel Printer PowerType Technical Manual*
3. Hand tools
4. DVOM
5. Dual-trace oscilloscope
6. Troubleshooting log (from previous job sheets)
7. Replacement parts as required

B. Procedure for removing the control drive board (Figure 1)

(NOTE: The procedures and illustrations in this job sheet are adapted from materials copyrighted © 1984 by Star Micronics, Inc., and are reprinted with permission.)

1. Sign on your troubleshooting log, and be sure to save your log for future job sheets

   (NOTE: The figures that accompany this job sheet are at the end of the job sheet so the separate illustrations can be used more easily in the troubleshooting routine.)

2. Turn the power switch OFF and remove the power cord from the back of the printer
3. Remove the upper case and cover as outlined in a previous job sheet
4. Remove the ribbon cable connected to the control logic board from CN2 on the control drive board
5. Remove the connectors CN1, CN3, CN4, CN5, and CN6 on the control drive board, and label as necessary to keep them in order
6. Remove the CN1 parallel interface connector and the CN6 serial interface connector on the control logic board

   (NOTE: Take your time with this routine, and be sure to keep track of where things come from so you'll know where they go when it's time to put things back together.)

JOB SHEET #4

7. Remove the ground line connected to TAB 1

8. Remove the M3 × 5 screw that secures the control drive board ground line to the printer base, and temporarily put the screw back where it came from or place it safely aside

9. Remove the M3 × 5 screw that secures the serial interface connector unit to its metal fittings, and save the screw

10. Remove the two M3 × 5 screws that secure the control drive board to the base of the frame, and save the screws

11. Remove the two M3 × 5 screws that secure the control logic board to the angle (save the screws)

13. Lift the control drive board gently up to remove it

    (CAUTION: Do not remove the screws that secure IC5 because it is very easy to break the IC.)

    ☐ Have your instructor check your work

C. Procedure for replacing the control drive board (Figure 1)

1. Stop at this point and complete any troubleshooting activities that your instructor may assign

2. Replace the control drive board by reversing the removal procedure

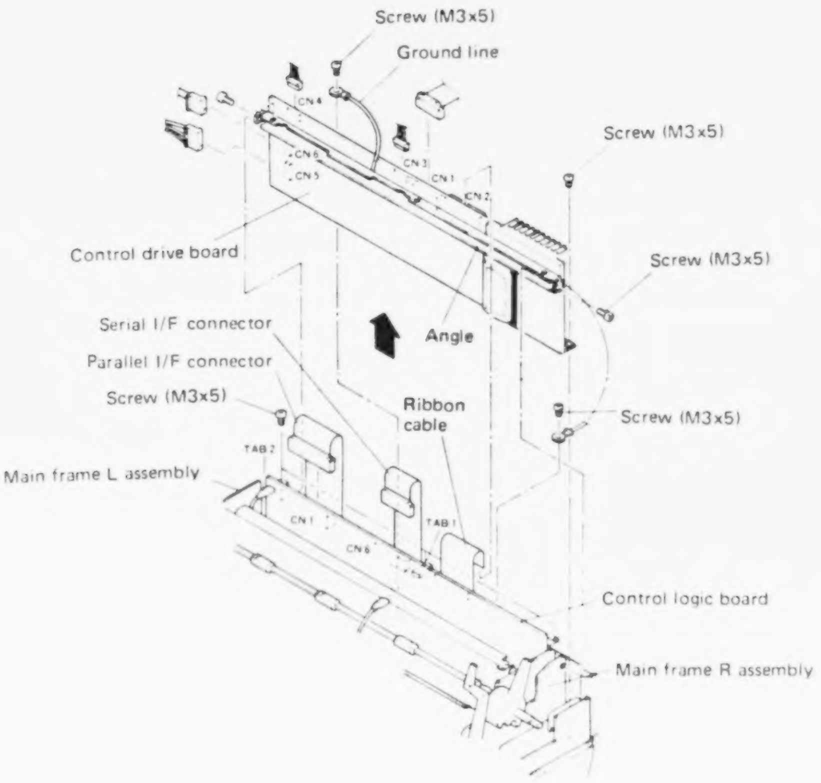
3. Sign off your troubleshooting log

    ☐ Have your instructor check your work

4. Clean up area and return tools and equipment to proper storage, or prepare for next job sheet as directed by your instructor

JOB SHEET #4

FIGURE 1


Screw (M3x5)
Ground line
CN4
CN6
CN5
CN3
CN1
CN2
Screw (M3x5)
Control drive board
Screw (M3x5)
Angle
Serial I/F connector
Parallel I/F connector
Screw (M3x5)
Ribbon cable
Screw (M3x5)
TAB2
Main frame L assembly
CN1
CN6
TAB1
Control logic board
Main frame R assembly

Courtesy Star Micronics

SERVICING AND REPAIRING LETTER-QUALITY PRINTERS
UNIT III

JOB SHEET #5 — REMOVE AND REPLACE THE CONTROL LOGIC BOARD ON A POWERTYPE PRINTER

A. Tools and equipment

1. Printer as selected by instructor
2. *Daisywheel Printer PowerType Technical Manual*
3. Hand tools
4. DVOM
5. Dual-trace oscilloscope
6. Troubleshooting log (from previous job sheets)
7. Replacement parts as required

B. Procedure for removing the control logic board (Figure 1)

(NOTE: The procedures and illustrations in this job sheet are adapted from materials copyrighted © 1984 by Star Micronics, Inc., and are reprinted with permission.)

1. Sign on your troubleshooting log, and be sure to save your log for future job sheets

   (NOTE: The figures that accompany this job sheet are at the end of the job sheet so the separate illustrations can be used more easily in the troubleshooting routine.)

2. Turn the power switch OFF and remove the power cord from the back of the printer
3. Remove the upper case and cover as outlined in a previous job sheet
4. Remove the ribbon cable connected to the control drive board from the CN5 control logic board
5. Remove the CN1, CN2, CN3, and CN6 connectors from the control logic board
6. Remove the two M3 × 5 screws that secure the control logic board ground line to the metal fittings on the parallel and serial interfaces
7. Remove the three M3 × 5 screws that secure the control logic board to the control drive board angle

JOB SHEET #5

8. Lift the control logic board up gently, remove the CN8 and CN9, and then take out the board

   ☐ Have your instructor check your work

C. Procedure for replacing the control logic board (Figure 1)

1. Stop at this point and complete any troubleshooting activities that your instructor may assign

2. Replace the control logic board by reversing the removal procedure

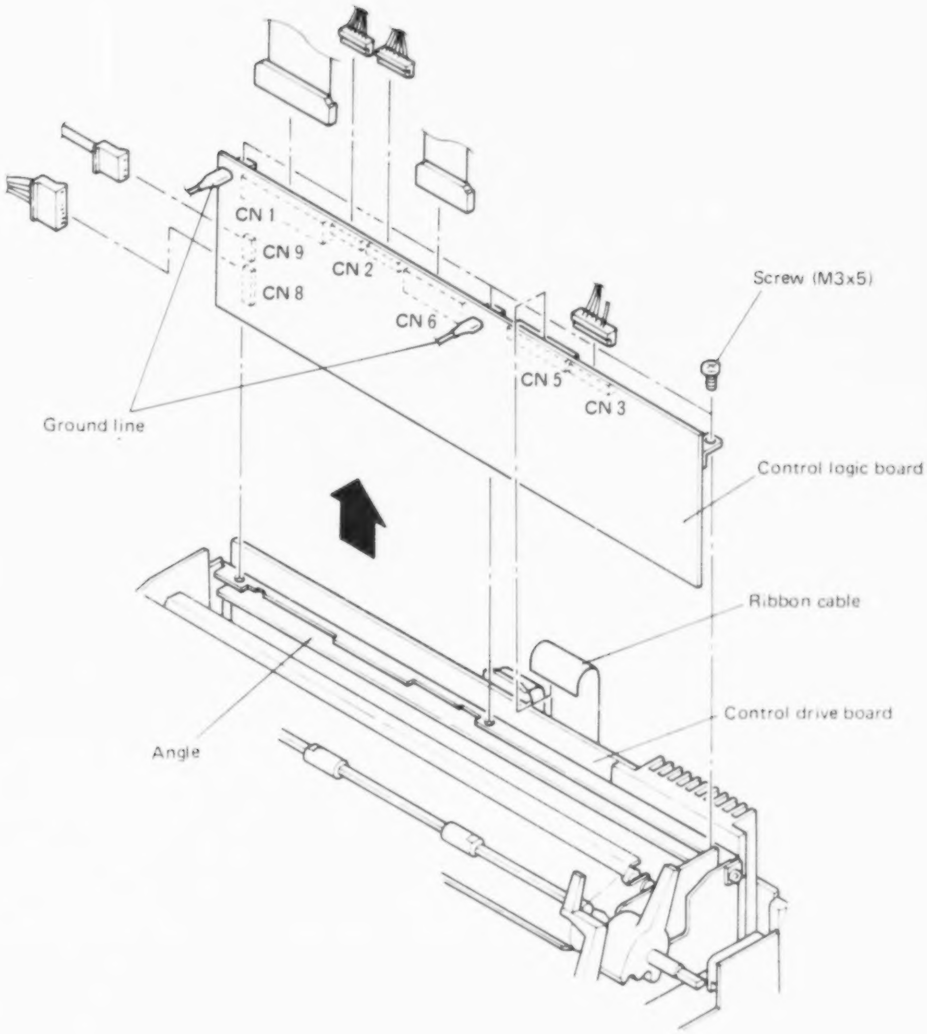
3. Sign off your troubleshooting log

   ☐ Have your instructor check your work

4. Clean up area and return tools and equipment to proper storage, or prepare for next job sheet as directed by your instructor

JOB SHEET #5

FIGURE 1


CN 1
CN 9
CN 2
CN 8
CN 6
Screw (M3x5)
CN 5
CN 3
Ground line
Control logic board
Ribbon cable
Control drive board
Angle

Courtesy Star Micronics, Inc.

SERVICING AND REPAIRING LETTER-QUALITY PRINTERS
UNIT III

JOB SHEET #6 — REMOVE AND REPLACE THE POWER REGULATOR UNIT AND THE POWER SUPPLY UNIT ON A POWERTYPE PRINTER

A. Tools and equipment

1. Printer as selected by instructor
2. *Daisywheel Printer PowerType Technical Manual*
3. Hand tools
4. DVOM
5. Dual-trace oscilloscope
6. Troubleshooting log (from previous job sheets)
7. Replacement parts as required

B. Procedure for removing the power regulator unit (Figure 1)

(NOTE: The procedures and illustrations in this job sheet are adapted from materials copyrighted © 1984 by Star Micronics, Inc., and are reprinted with permission.)

1. Sign on your troubleshooting log

   (NOTE: The figures that accompany this job sheet are at the end of the job sheet so the separate illustrations can be used more easily in the troubleshooting routine.)

2. Turn the power switch OFF and remove the power cord from the back of the printer
3. Remove the upper case and cover as outlined in a previous job sheet
4. Remove the control drive board and control logic board together with the following procedure

   (NOTE: This is a variation of a previous routine, but this removes both boards at once instead of one at a time and saves removal and replacement time.)

   a. Remove the CN1, CN3, CN4, and CN5 connectors to the control drive board

   b. Remove the CN1, CN2, CN3, and CN6 connectors to the control logic board, and the ground lines connected to TAB 1 and TAB 2

JOB SHEET #6

   c. Remove the M3 × 5 screws that secure the ground line of the control drive board to the frame base, and then the screw that secures the metal fitting to the serial interface; then remove the ground line

   d. Remove the two M3 × 5 screws that secure the angle which connects the control drive board and the control logic board to the left and right sides of the frame

   e. Remove the two M3 × 5 screws that secure the control drive board to the frame

   f. Lift up the control drive board and the control logic board together, and remove the connectors connected to CN8 of the control logic board

   g. Lift up gently to remove the two boards together

5. Remove the four M3 × 6 screws that secure the power regulator unit

6. Pull backwards on the power regulator unit from inside the printer so you can remove the connector that is connected to the CN1 and CN2 of the power regulator unit

7. Remove the power regulator unit

   ☐ Have your instructor check your work

C. Procedure for setting and checking a new power regulator unit (Figure 2)

1. Remove the six M3 × 6 screws that secure the unit cover, and remove the cover

2. Check the J3 jumper as indicated in Figure 2, and if the voltage is incorrect, use the following procedure:

   a. Loosen the two M3 ×16 screws that secure IC1 to the case along with all M3 × 14 and M3 × 12 screws (loosen only)

   b. Remove the five M3 × 18 screws that secure the board of the power regulator unit

   c. Use pliers to pick the top of the four board spacers that secure the board, then remove the board

3. Set J3 correctly

4. Replace the regulator unit by reversing the removal procedure, but slip insulation sheets between IC1, D3, D4, and TR2 and the case

5. Check to make sure the ground line is properly replaced

JOB SHEET #6

☐ Have your instructor check your work

D. Procedure for removing and replacing a power supply unit (Figure 3)

1. Remove the four M3 × 6 screws that secure the power supply to the frame
2. Lift the unit up and out
3. Reverse the removal procedure when replacing a faulty power supply with a new one

☐ Have your instructor check your work

E. Procedure for replacing the power regulator unit (Figure 1)

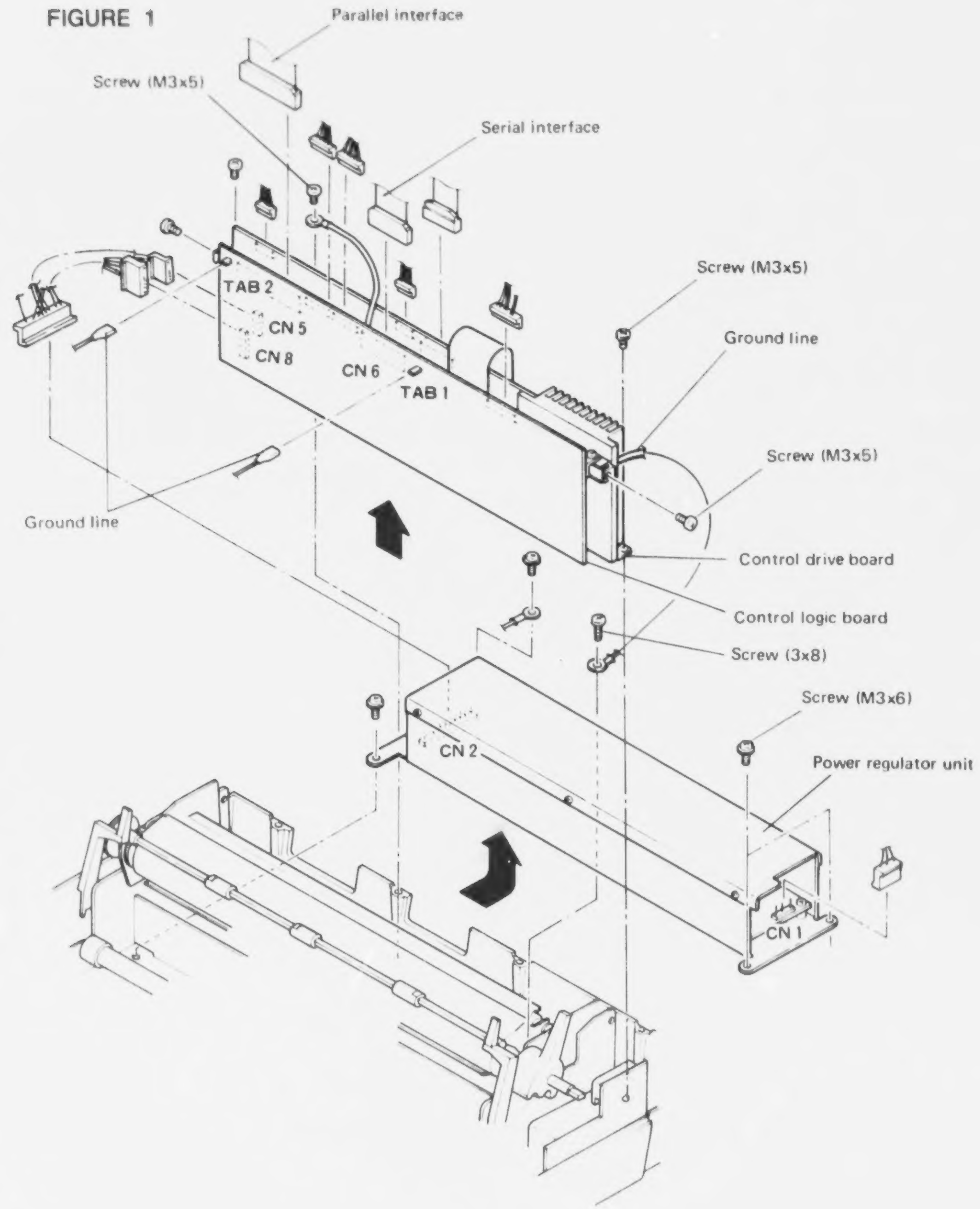
1. Complete any troubleshooting that can be finished at this point
2. Reverse the removal procedure to replace the power regulator unit
3. Sign off your troubleshooting log

☐ Have your instructor check your work

4. Clean up area and return tools and equipment to proper storage, or prepare for next job sheet as directed by your instructor

JOB SHEET #6

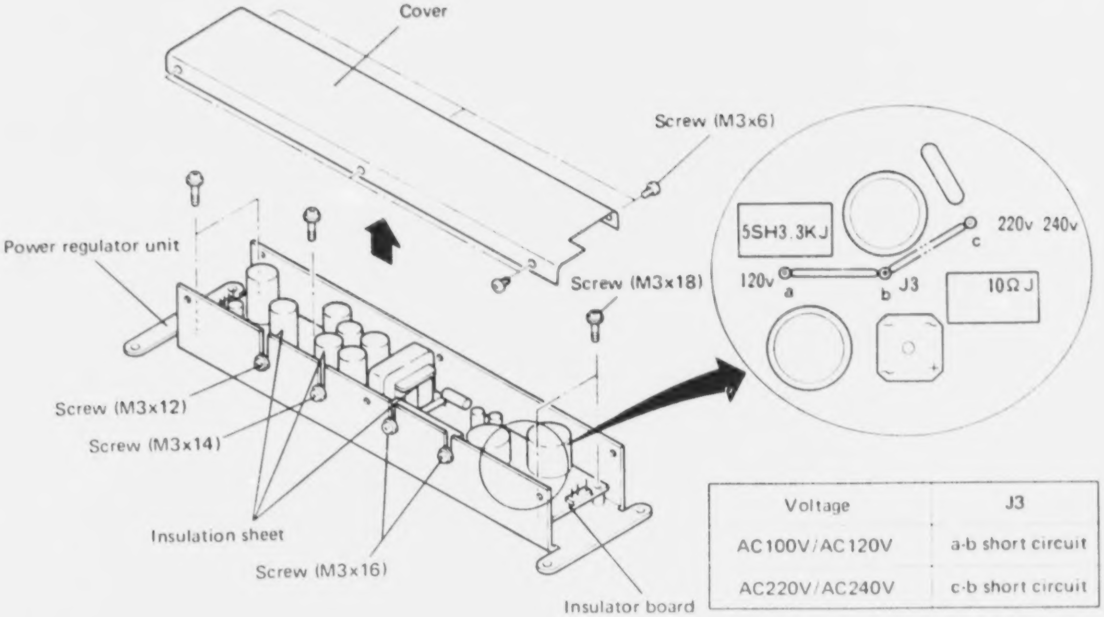
FIGURE 1


Parallel interface
Screw (M3x5)
Serial interface
TAB 2
CN 5
CN 8
CN 6
TAB 1
Screw (M3x5)
Ground line
Screw (M3x5)
Ground line
Control drive board
Control logic board
Screw (3x8)
Screw (M3x6)
CN 2
Power regulator unit
CN 1

Courtesy Star Micronics, Inc.

JOB SHEET #6

FIGURE 2

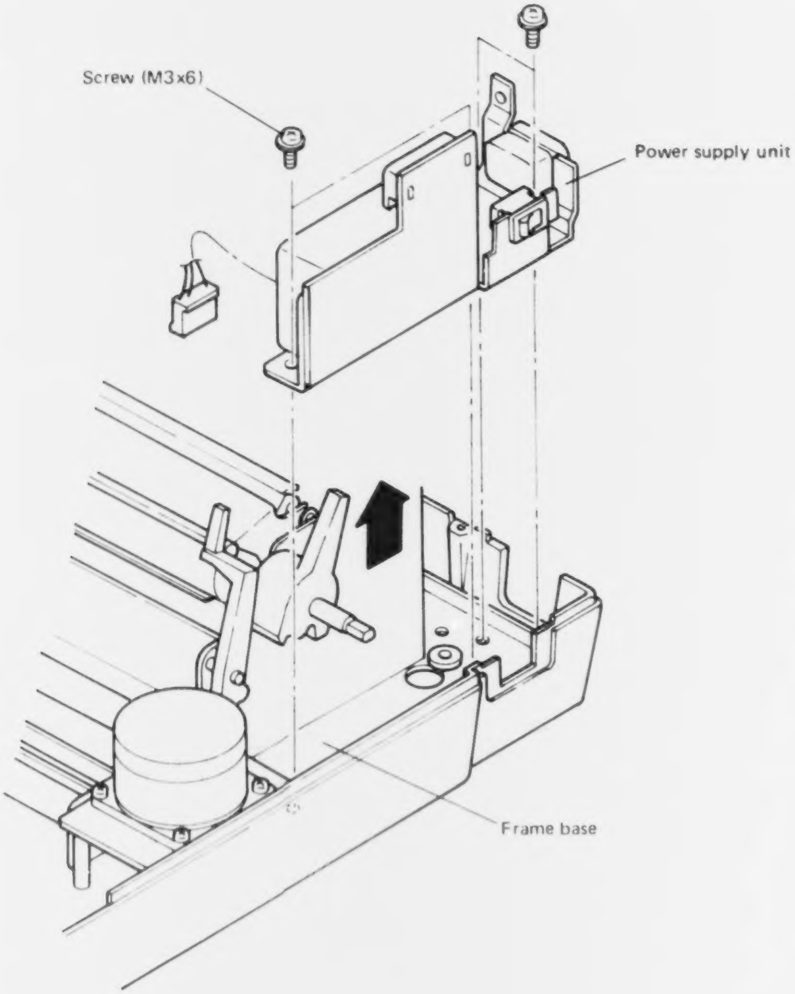

Cover
Screw (M3x6)
Power regulator unit
Screw (M3x18)
5SH3.3KJ
220v 240v
c
120v
a
b
J3
10Ω J
Screw (M3x12)
Screw (M3x14)
Insulation sheet
Screw (M3x16)
Insulator board

Voltage	J3
AC100V/AC120V	a-b short circuit
AC220V/AC240V	c-b short circuit

Courtesy Star Micronics, Inc.

JOB SHEET #6

FIGURE 3


Screw (M3x6)
Power supply unit
Frame base

Courtesy Star Micronics, Inc.

SERVICING AND REPAIRING LETTER-QUALITY PRINTERS
UNIT III

JOB SHEET #7 — REMOVE AND REPLACE THE PRINTER MECHANISM ON A POWERTYPE PRINTER

A. Tools and equipment

1. Printer as selected by instructor
2. *Daisywheel Printer PowerType Technical Manual*
3. Hand tools
4. DVOM
5. Dual-trace oscilloscope
6. Troubleshooting log (from previous job sheets)
7. Replacement parts as required

B. Procedure for removing the printer mechanism

(NOTE: The procedures and illustrations in this job sheet are adapted from materials copyrighted ©1984 by Star Micronics, Inc., and are reprinted with permission.)

1. Sign on your troubleshooting log

   (NOTE: The figures that accompany this job sheet are at the end of the job sheet so the separate illustrations can be used more easily in the troubleshooting routine.)

2. Turn the power switch OFF and remove the power cord from the back of the printer
3. Remove the upper case and cover as outlined in a previous job sheet
4. Check to see if the three M3 × 5 shipping screws are still in the bottom of the printer, and if so, remove them (Figure 1)
5. Remove the connectors connected to the CN1 and CN2 of the control panel board
6. Remove the six M4 × 12 screws that secure the printer mechanisms to the lower case along with their washers, and be sure to keep the screws with washers in order

   (**CAUTION:** Do not damage the rubber feet around the screws because they not only support the printer, they absorb shock and vibration during operation, so if the rubber feet are damaged, they should be replaced.)

JOB SHEET #7

7. Remove the control drive board, the power regulator unit, and the power supply unit as outlined in a previous job sheet (Figure 2)

   ☐ Have your instructor check your work

C. Procedure for replacing the printer mechanism

1. Complete any troubleshooting that can be finished at this point

2. Replace the printer mechanism by reversing the removal procedure, and remember to be careful with the rubber feet on the bottom of the printer

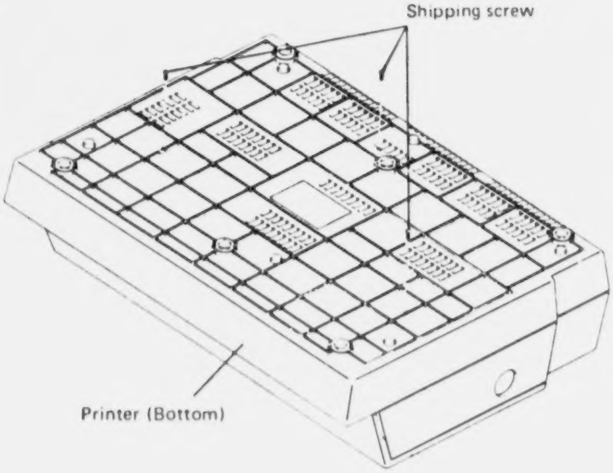
3. Sign off your troubleshooting log

   ☐ Have your instructor check your work

4. Clean up area and return tools and equipment to proper storage, or prepare for next job sheet as directed by your instructor

JOB SHEET #7

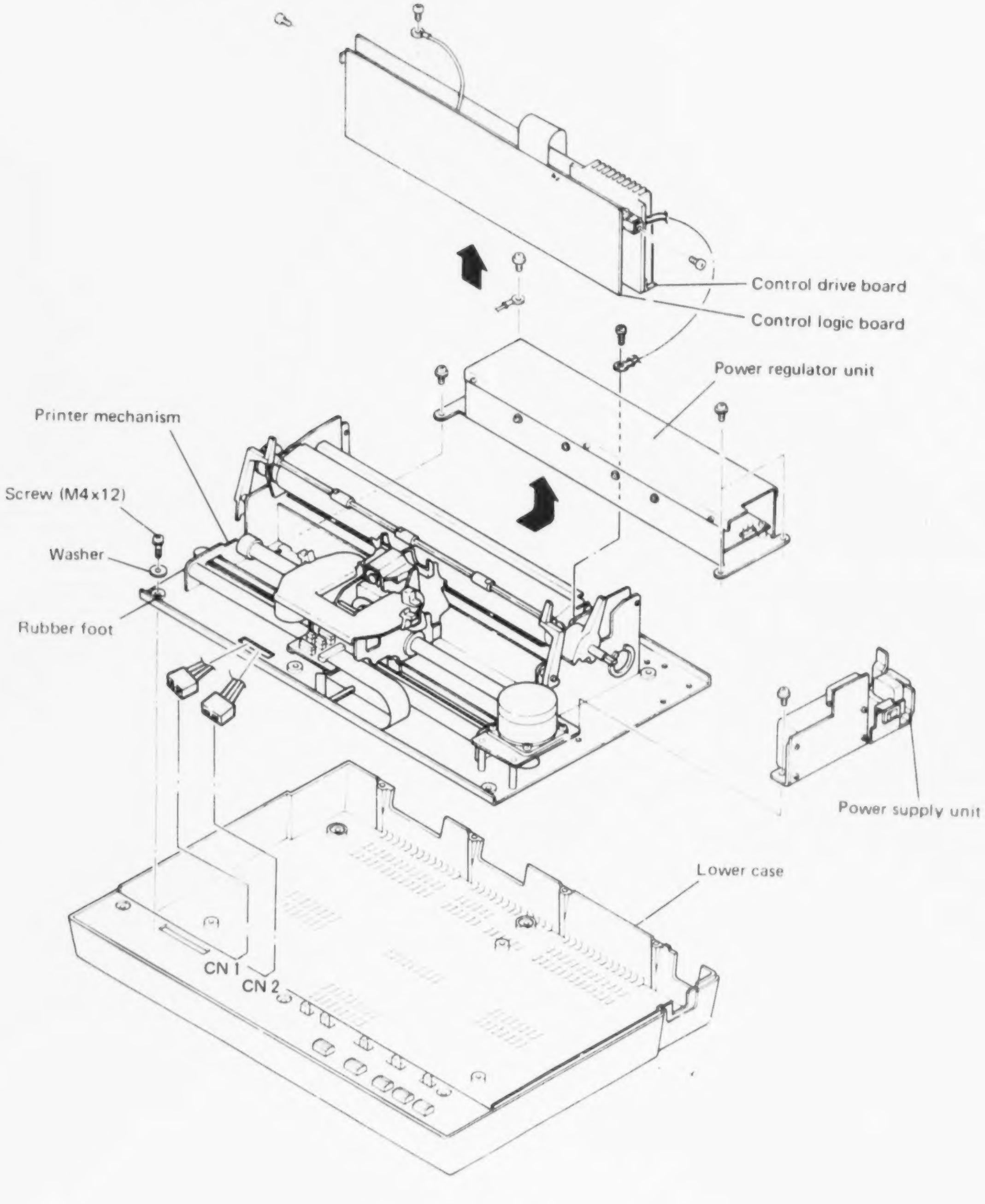
FIGURE 1


Shipping screw
Printer (Bottom)

Courtesy Star Micronics, Inc.

JOB SHEET #7

FIGURE 2


Control drive board
Control logic board
Power regulator unit
Printer mechanism
Screw (M4x12)
Washer
Rubber foot
Power supply unit
Lower case
CN 1
CN 2

Courtesy Star Micronics, Inc.

SERVICING AND REPAIRING LETTER-QUALITY PRINTERS
UNIT III

JOB SHEET #8 — REMOVE AND REPLACE THE PAPER FEED ASSEMBLY ON A POWERTYPE PRINTER

A. Tools and equipment

1. Printer as selected by instructor
2. *Daisywheel Printer PowerType Technical Manual*
3. Hand tools
4. DVOM
5. Dual-trace oscilloscope
6. Troubleshooting log (from previous job sheets)
7. Replacement parts as required

B. Procedure for removing the paper feed assembly (Figure 1)

(NOTE: The procedures and illustrations in this job sheet are adapted from materials copyrighted ©1984 by Star Micronics, Inc., and are reprinted with permission.)

1. Sign on your troubleshooting log

   (NOTE: The figures that accompany this job sheet are at the end of the job sheet so the separate illustrations can be used more easily in the troubleshooting routine.)

2. Turn the power switch OFF and remove the power cord from the back of the printer
3. Remove the upper case and cover as outlined in a previous job sheet
4. Remove the power regulator unit as outlined in a previous job sheet
5. Remove the four M3 × 4 screws that secure the paper feed motor
6. Remove the paper feed motor connector if the paper feed motor has to be replaced

   ☐ Have your instructor check your work

JOB SHEET #8

C. Procedure for replacing the paper feed assembly (Figure 1)

1. Complete installation of a new paper feed motor if required

2. Reverse the removal procedure to replace the paper feed assembly

   (NOTE: Do not press the motor drive pinion against the idler gear, but do adjust backlash so the platen rotates smoothly.)

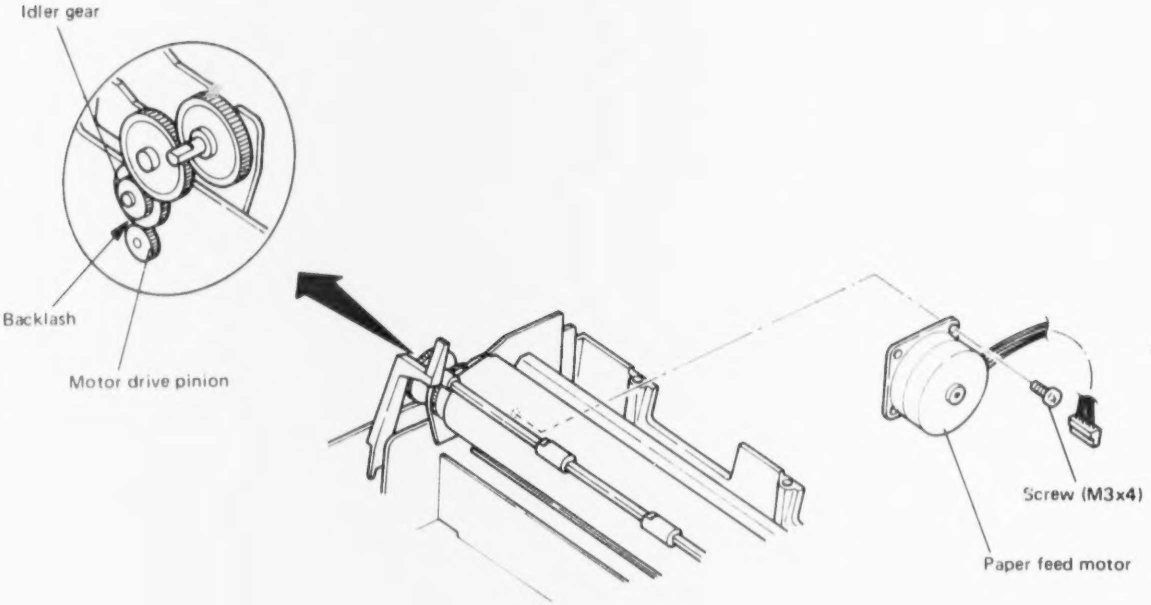
3. Sign off your troubleshooting log

   ☐ Have your instructor check your work

4. Clean up area and return tools and equipment to proper storage, or prepare for next job sheet as directed by your instructor

JOB SHEET #8

FIGURE 1


Idler gear
Backlash
Motor drive pinion
Screw (M3x4)
Paper feed motor

Courtesy Star Micronics, Inc.

SERVICING AND REPAIRING LETTER-QUALITY PRINTERS
UNIT III

JOB SHEET #9 — REMOVE AND REPLACE THE CARRIAGE MOTOR ASSEMBLY ON A POWERTYPE PRINTER

A. Tools and equipment

1. Printer as selected by instructor
2. *Daisywheel Printer PowerType Technical Manual*
3. Hand tools
4. DVOM
5. Dual-trace oscilloscope
6. Troubleshooting log (from previous job sheets)
7. Replacement parts as required

B. Procedure for removing the paper feed assembly (Figure 1)

(NOTE: The procedures and illustrations in this job sheet are adapted from materials copyrighted ©1984 by Star Micronics, Inc., and are reprinted with permission.)

1. Sign on your troubleshooting log

   (NOTE: The figures that accompany this job sheet are at the end of the job sheet so the separate illustrations can be used more easily in the troubleshooting routine.)

2. Turn the power switch OFF and remove the power cord from the back of the printer
3. Remove the upper case and cover as outlined in a previous job sheet
4. Loosen the two M3 × 6 screws that secure the pulley tension lever so that tension on the timing belt will loosen too
5. Remove the connector at the end of the carriage motor lead line from CN3 on the control board
6. Remove the four M4 × 10 screws that secure the carriage motor, then remove the timing belt from the timing pulley

   ☐ Have your instructor check your work

JOB SHEET #9

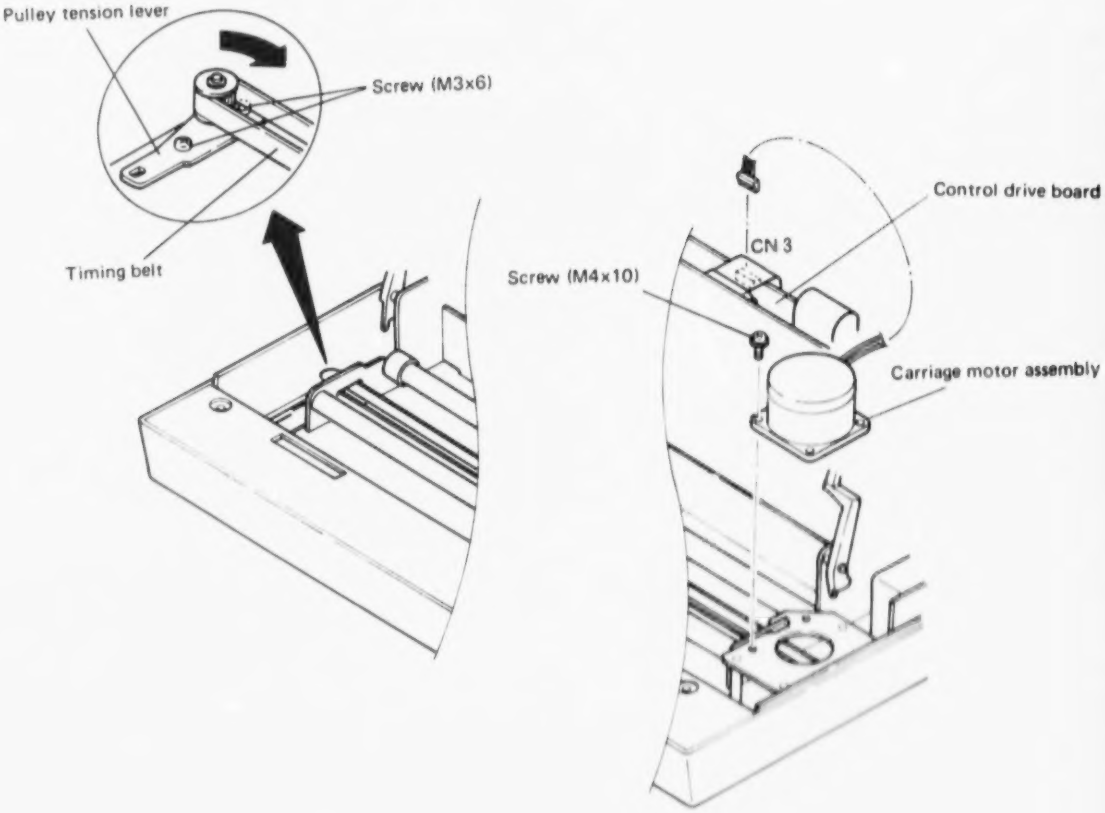
C. Procedure for replacing the carriage motor assembly (Figure 1)

1. Complete all troubleshooting that can be finished at this point
2. Replace timing belt, if required, and adjust the timing belt as outlined in Job Sheet #26, or as directed by your instructor
3. Replace the carriage motor assembly by reversing the removal procedure
4. Sign off your troubleshooting log

   ☐ Have your instructor check your work
5. Clean up area and return tools and equipment to proper storage, or prepare for next job sheet as directed by your instructor

JOB SHEET #9

FIGURE 1


Pulley tension lever
Screw (M3x6)
Timing belt
Control drive board
CN 3
Screw (M4x10)
Carriage motor assembly

Courtesy Star Micronics, Inc.

SERVICING AND REPAIRING LETTER-QUALITY PRINTERS
UNIT III

JOB SHEET #10 — REMOVE AND REPLACE THE RIBBON FEED MOTOR ASSEMBLY ON A POWERTYPE PRINTER

A. Tools and equipment

1. Printer as selected by instructor
2. *Daisywheel Printer PowerType Technical Manual*
3. Hand tools
4. DVOM
5. Dual-trace oscilloscope
6. Troubleshooting log (from previous job sheets)
7. Replacement parts as required

B. Procedure for removing the paper feed assembly (Figure 1)

(NOTE: The procedures and illustrations in this job sheet are adapted from materials copyrighted ©1984 by Star Micronics, Inc., and are reprinted with permission.)

1. Sign on your troubleshooting log

   (NOTE: The figures that accompany this job sheet are at the end of the job sheet so the separate illustrations can be used more easily in the troubleshooting routine.)

2. Turn the power switch OFF and remove the power cord from the back of the printer
3. Remove the upper case and cover as outlined in a previous job sheet
4. Remove the ink ribbon cassette
5. Remove the connector that leads from the ribbon base assembly to the terminal board
6. Remove the ribbon end connector that leads from the ribbon feed motor assembly to the terminal board
7. Remove the two M3 × 4 screws that secure the ribbon feed motor assembly

   ☐ Have your instructor check your work

JOB SHEET #10

C. Procedure for replacing the ribbon feed motor assembly (Figure 1)

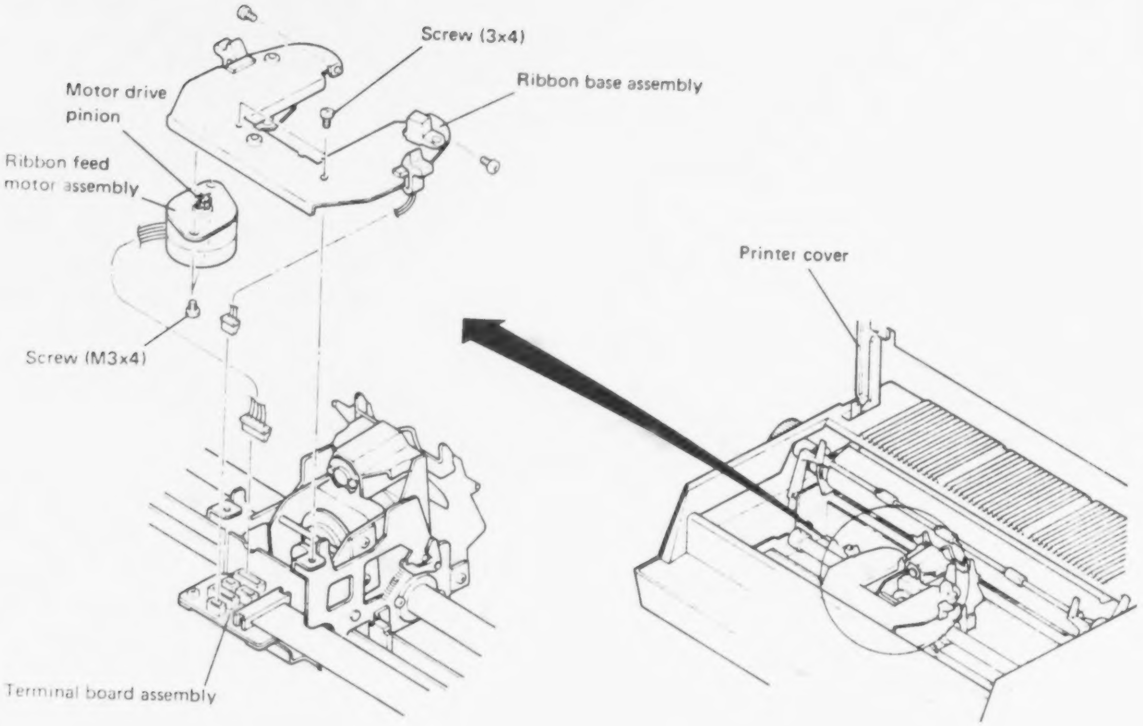
1. Complete all troubleshooting that can be finished at this point
2. Replace the ribbon feed motor, if required
3. Replace the ribbon feed motor assembly by reversing the removal procedure, but do not press the motor drive pinion against the idler gear, rather, adjust the backlash so that the platen turns smoothly
4. Sign off your troubleshooting log

   ☐ Have your instructor check your work

5. Clean up area and return tools and equipment to proper storage, or prepare for next job sheet as directed by your instructor

JOB SHEET #10

FIGURE 1


Screw (3x4)
Ribbon base assembly
Motor drive pinion
Ribbon feed motor assembly
Printer cover
Screw (M3x4)
Terminal board assembly

Courtesy Star Micronics, Inc.

SERVICING AND REPAIRING LETTER-QUALITY PRINTERS
UNIT III

JOB SHEET #11 — REMOVE AND REPLACE THE HAMMER UNIT ON A POWERTYPE PRINTER

A. Tools and equipment

1. Printer as selected by instructor
2. *Daisywheel Printer PowerType Technical Manual*
3. Hand tools
4. DVOM
5. Dual-trace oscilloscope
6. Troubleshooting log (from previous job sheets)
7. Replacement parts as required

B. Procedure for removing the paper feed assembly (Figure 1)

(NOTE: The procedures and illustrations in this job sheet are adapted from materials copyrighted ©1984 by Star Micronics, Inc., and are reprinted with permission.)

1. Sign on your troubleshooting log

   (NOTE: The figures that accompany this job sheet are at the end of the job sheet so the separate illustrations can be used more easily in the troubleshooting routine.)

2. Turn the power switch OFF and remove the power cord from the back of the printer
3. Remove the upper case and cover as outlined in a previous job sheet
4. Remove the ink ribbon cassette
5. Remove the connector at the end of the hammer unit, the line that leads from the terminal board
6. Push down the bail lever toward the back of the printer, and pull the hammer cover forward to the clamp position
7. Remove the printwheel, and then remove the two M2.6 × 6 screws that secure the hammer unit

JOB SHEET #11

8. Return the hammer cover to its former position, then pull out the hammer unit to the rear of the hammer cover

   ☐ Have your instructor check your work

C. Procedure for replacing the hammer unit (Figure 1)

1. Complete all troubleshooting that can be finished at this point

2. Replace the hammer unit by reversing the removal procedure

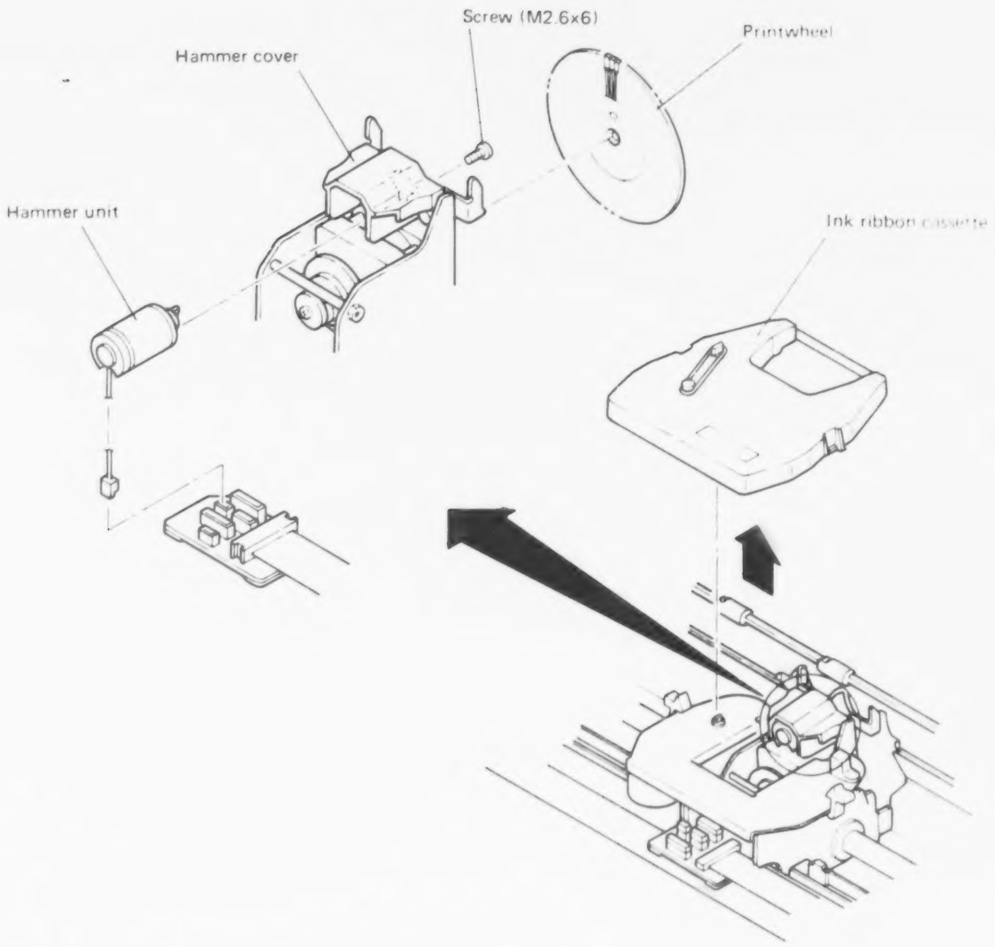
3. Sign off your troubleshooting log

   ☐ Have your instructor check your work

4. Clean up area and return tools and equipment to proper storage, or prepare for next job sheet as directed by your instructor

JOB SHEET #11

FIGURE 1


Screw (M2.6x6)
Printwheel
Hammer cover
Hammer unit
Ink ribbon cassette

Courtesy Star Micronics, Inc.

SERVICING AND REPAIRING LETTER-QUALITY PRINTERS
UNIT III

JOB SHEET #12 — REMOVE AND REPLACE THE CARRIAGE STAY ON A POWERTYPE PRINTER

A. Tools and equipment

1. Printer as selected by instructor
2. *Daisywheel Printer PowerType Technical Manual*
3. Hand tools
4. DVOM
5. Dual-trace oscilloscope
6. Troubleshooting log (from previous job sheets)
7. Replacement parts as required

B. Procedure for removing the paper feed assembly (Figure 1)

(NOTE: The procedures and illustrations in this job sheet are adapted from materials copyrighted © 1984 by Star Micronics, Inc., and are reprinted with permission.)

1. Sign on your troubleshooting log

   (NOTE: The figures that accompany this job sheet are at the end of the job sheet so the separate illustrations can be used more easily in the troubleshooting routine.)

2. Turn the power switch OFF and remove the power cord from the back of the printer
3. Remove the upper case and cover as outlined in a previous job sheet
4. Remove the printer mechanism as outlined in a previous job sheet
5. Loosen the two M3 × 4 screws that secure the pulley tension lever, and then remove the timing belt from the idler pulley
6. Remove the M3 × 4 screws that secure the stay holders to the frame on each end of the carriage stay
7. Use the carriage stay as a fulcrum to lift the carriage upwards, and then remove the carriage stay from the main frame right and left

JOB SHEET #12

8. Pull the right and left carriage stoppers out, and then pull the carriage stay out of the carriage

   ☐ Have your instructor check your work

C. Procedure for replacing the carriage stay (Figure 1)

1. Complete all troubleshooting that can be finished at this point

2. Replace and adjust the timing belt as needed

3. Replace the carriage stay by reversing the removal procedure

   (NOTE: Be sure to press the stay holders close to the carriage stay so that they do not rattle; this is demonstrated in Figure 1.)

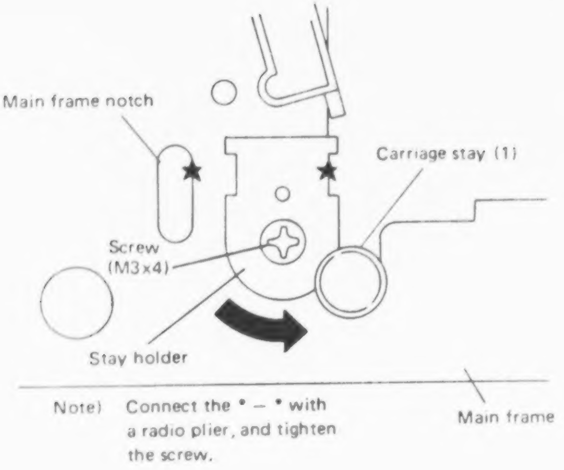
4. Sign off your troubleshooting log

   ☐ Have your instructor check your work

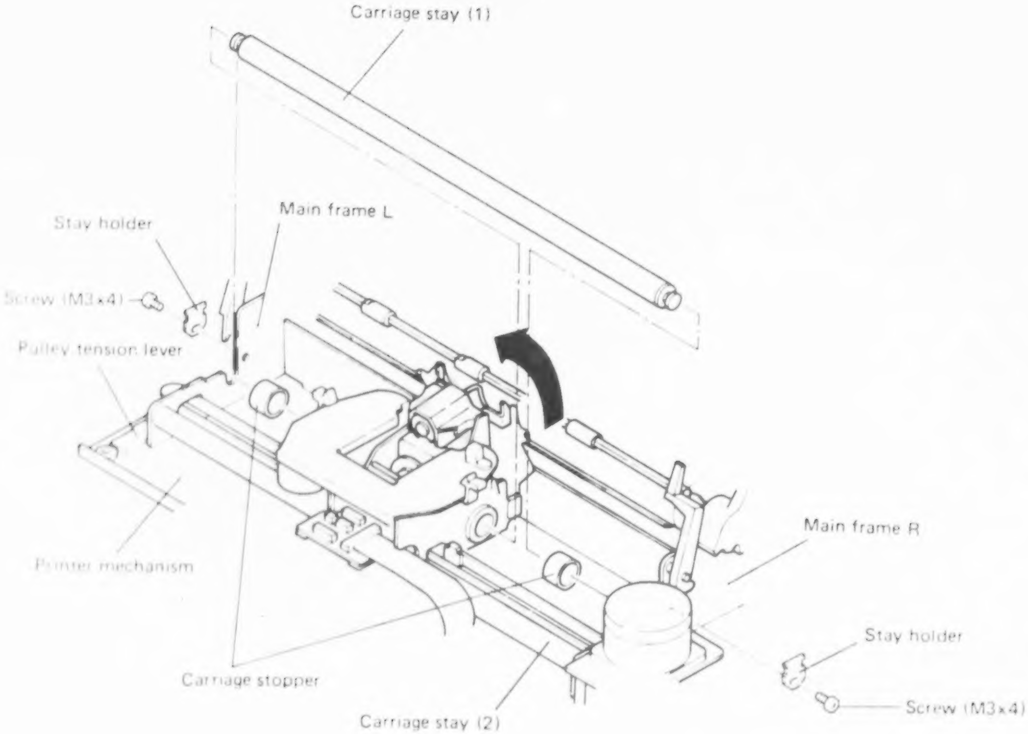
5. Clean up area and return tools and equipment to proper storage, or prepare for next job sheet as directed by your instructor

JOB SHEET #12

FIGURE 1


Main frame notch
Carriage stay (1)
Screw
(M3x4)
Stay holder
Main frame

Note) Connect the ★ – ★ with a radio plier, and tighten the screw.


Carriage stay (1)
Stay holder
Main frame L
Screw (M3x4)
Pulley tension lever
Printer mechanism
Main frame R
Stay holder
Carriage stopper
Screw (M3x4)
Carriage stay (2)

Courtesy Star Micronics, Inc.

SERVICING AND REPAIRING LETTER-QUALITY PRINTERS
UNIT III

JOB SHEET #13 — REMOVE AND REPLACE THE CARRIAGE ASSEMBLY ON A POWERTYPE PRINTER

A. Tools and equipment

1. Printer as selected by instructor
2. *Daisywheel Printer PowerType Technical Manual*
3. Hand tools
4. DVOM
5. Dual-trace oscilloscope
6. Troubleshooting log (from previous job sheets)
7. Replacement parts as required

B. Procedure for removing the paper feed assembly (Figure 1)

(NOTE: The procedures and illustrations in this job sheet are adapted from materials copyrighted ©1984 by Star Micronics, Inc., and are reprinted with permission.)

1. Sign on your troubleshooting log

   (NOTE: The figures that accompany this job sheet are at the end of the job sheet so the separate illustrations can be used more easily in the troubleshooting routine.)

2. Turn the power switch OFF and remove the power cord from the back of the printer
3. Remove the upper case and cover as outlined in a previous job sheet
4. Remove the printer mechanism as outlined in a previous job sheet
5. Remove the ink ribbon cassette and the printwheel
6. Remove the four M3 × 4 screws that secure the ribbon base
7. Remove the connectors of the ribbon end detector
8. Remove the connectors of the ribbon feed motor from the terminal board
9. Remove the ribbon base assembly from the carriage

JOB SHEET #13

10. Remove the two M3 × 4 screws that secure the terminal board, and carefully take the terminal board out of the carriage assembly

11. Loosen the two M3 × 6 screws that secure the pulley tension lever, and then remove the timing belt from the idler pulley

12. Remove the four M4 × 10 screws that secure the carriage motor, and then remove the timing belt from the motor timing pulley

13. Remove the carriage stay as outlined in a previous job sheet

    ☐ Have your instructor check your work

C. Procedure for replacing the carriage assembly (Figure 1)

1. Complete all troubleshooting that can be finished at this point

2. Replace and adjust the timing belt as required

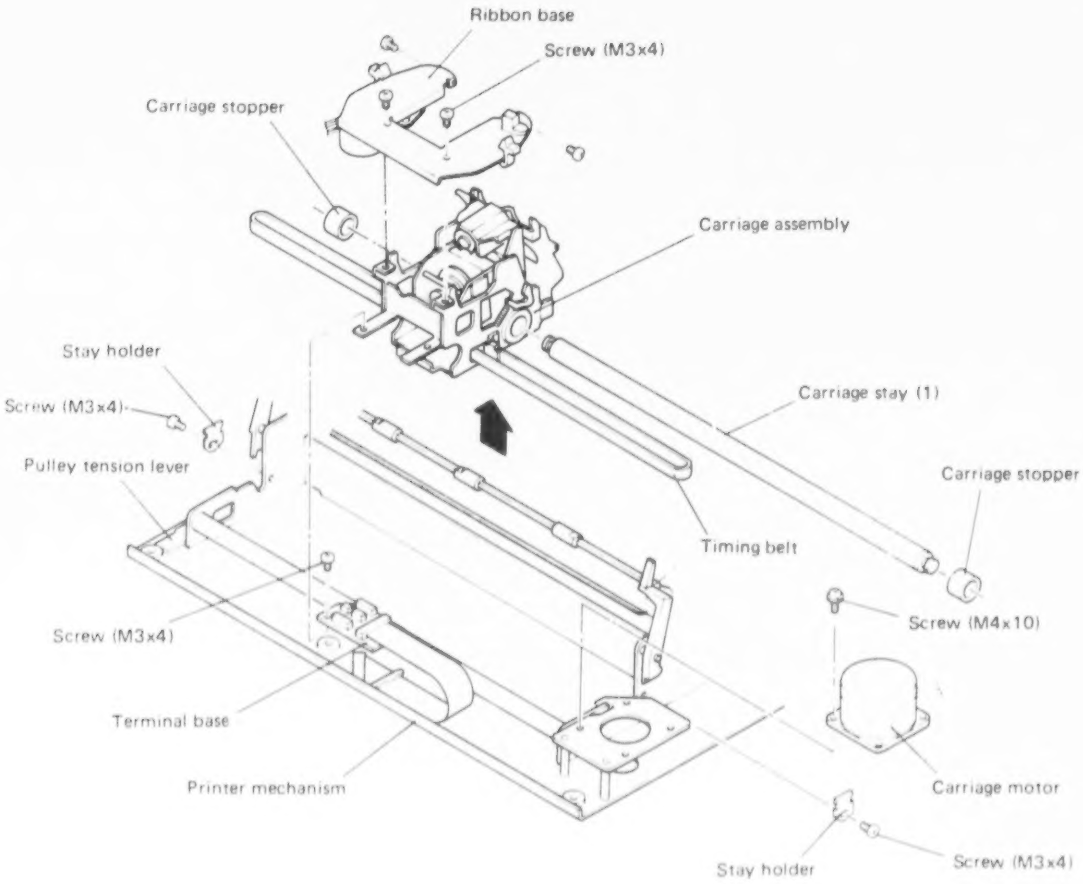
3. Sign off your troubleshooting log

    ☐ Have your instructor check your work

4. Clean up area and return tools and equipment to proper storage, or prepare for next job sheet as directed by your instructor

JOB SHEET #13

FIGURE 1


Ribbon base
Screw (M3x4)
Carriage stopper
Carriage assembly
Stay holder
Screw (M3x4)
Pulley tension lever
Carriage stay (1)
Carriage stopper
Timing belt
Screw (M4x10)
Screw (M3x4)
Terminal base
Printer mechanism
Carriage motor
Stay holder
Screw (M3x4)

Courtesy Star Micronics, Inc.

SERVICING AND REPAIRING LETTER-QUALITY PRINTERS
UNIT III

JOB SHEET #14 — REMOVE AND REPLACE THE PLATEN COVER AND PLATEN ASSEMBLY ON A POWERTYPE PRINTER

A. Tools and equipment

1. Printer as selected by instructor
2. *Daisywheel Printer PowerType Technical Manual*
3. Hand tools
4. DVOM
5. Dual-trace oscilloscope
6. Troubleshooting log (from previous job sheets)
7. Replacement parts as required

B. Procedure for removing the paper feed assembly (Figure 1)

(NOTE: The procedures and illustrations in this job sheet are adapted from materials copyrighted © 1984 by Star Micronics, Inc., and are reprinted with permission.)

1. Sign on your troubleshooting log

   (NOTE: The figures that accompany this job sheet are at the end of the job sheet so the separate illustrations can be used more easily in the troubleshooting routine.)

2. Turn the power switch OFF and remove the power cord from the back of the printer
3. Remove the upper case and cover as outlined in a previous job sheet
4. Remove the springs at both ends of the platen cover
5. Remove the stop ring at the left end of the paper chute stay

   (NOTE: When you are only going to push the platen cover back, the stop ring doesn't have to be removed.)

6. Move the platen cover to the left along the paper chute stay, then pull out the platen cover

JOB SHEET #14

C. Procedure for removing the platen assembly (Figure 2)

1. Replace the stop ring, and with the springs still removed from the platen cover, push it backwards
2. Pull the bail lever forward
3. Remove the stop ring (E6) at the left end of the platen shaft
4. Remove the gear from the platen shaft
5. Push out the bushing fitted into the left side of the sub frame guide ditch, and remove the bushing
6. Remove the other stop ring (E6) from the right end of the platen shaft
7. Remove the two poly sliders
8. Pull forward to release the lever, and remove the bushing on right side
9. Keep the spring inside the sub frame on the right, then pick up both ends of the platen assembly and lift it carefully from the guide ditch
10. Remove the bushing, spring, and brake plate from the platen assembly

    ☐ Have your instructor check your work

D. Procedure for replacing the platen assembly and platen cover (Figures 1 and 2)

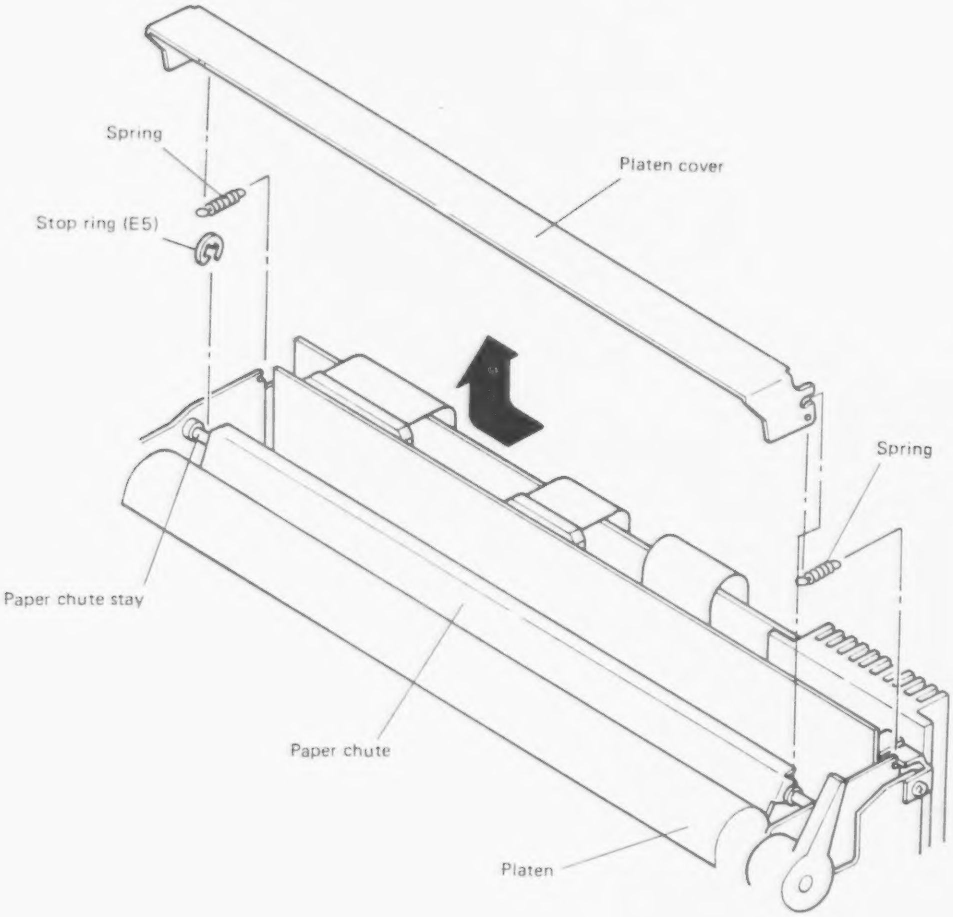
1. Complete all troubleshooting that can be finished at this point
2. Replace the platen assembly first by reversing the removal procedure, and then replace the platen cover by reversing the removal procedure
3. Sign off your troubleshooting log

    ☐ Have your instructor check your work

4. Clean up area and return tools and equipment to proper storage, or prepare for next job sheet as directed by your instructor

JOB SHEET #14

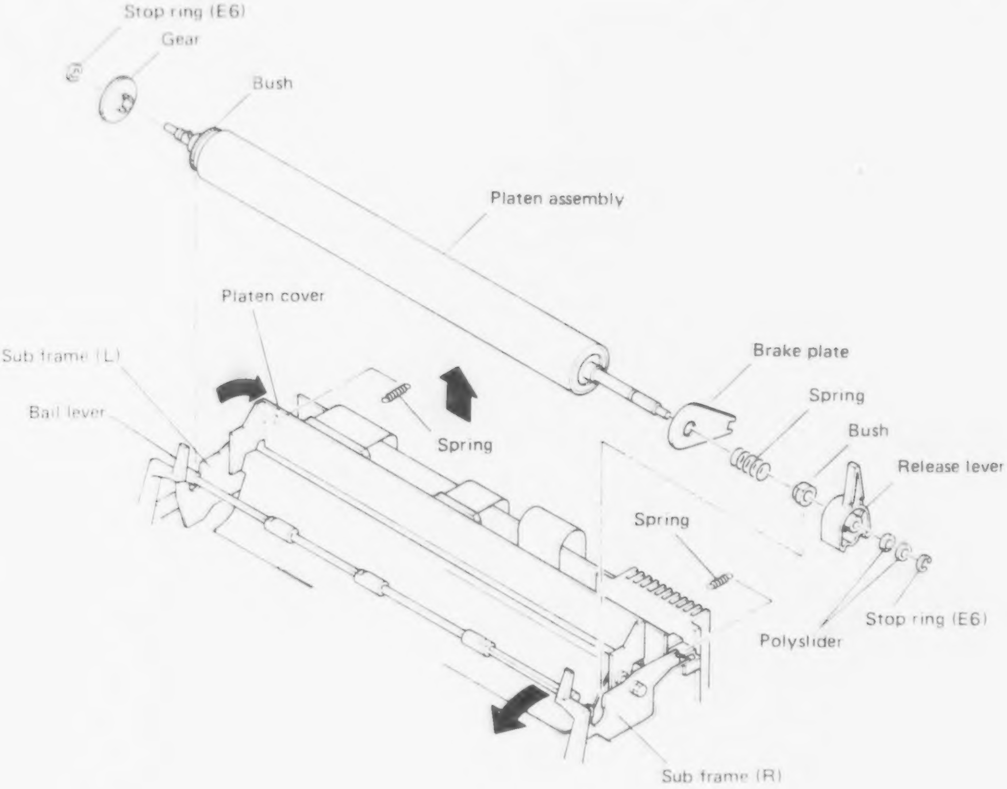
FIGURE 1


Spring
Stop ring (E5)
Platen cover
Spring
Paper chute stay
Paper chute
Platen

Courtesy Star Micronics, Inc.

JOB SHEET #14

FIGURE 2


Stop ring (E6)
Gear
Bush
Platen assembly
Platen cover
Sub frame (L)
Bail lever
Spring
Brake plate
Spring
Bush
Release lever
Spring
Polyslider
Stop ring (E6)
Sub frame (R)

Courtesy Star Micronics, Inc.

SERVICING AND REPAIRING LETTER-QUALITY PRINTERS
UNIT III

JOB SHEET #15 — REMOVE AND REPLACE THE PAPER CHUTE ASSEMBLY ON A POWERTYPE PRINTER

A. Tools and equipment

1. Printer as selected by instructor
2. *Daisywheel Printer PowerType Technical Manual*
3. Hand tools
4. DVOM
5. Dual-trace oscilloscope
6. Troubleshooting log (from previous job sheets)
7. Replacement parts as required

B. Procedure for removing the paper chute assembly (Figure 1)

(NOTE: The procedures and illustrations in this job sheet are adapted from materials copyrighted © 1984 by Star Micronics, Inc., and are reprinted with permission.)

1. Sign on your troubleshooting log

   (NOTE: The figures that accompany this job sheet are at the end of the job sheet so the separate illustrations can be used more easily in the troubleshooting routine.)

2. Turn the power switch OFF and remove the power cord from the back of the printer
3. Remove the upper case and cover as outlined in a previous job sheet
4. Remove the platen assembly as outlined in a previous job sheet
5. Disengage the paper chute assembly at the center hole where it meets the square hole of the bar underneath
6. Press down on the center hole of the paper chute pressure device, and lift the paper chute assembly up and off

   ☐ Have your instructor check your work

JOB SHEET #15

C. Procedure for replacing the paper chute assembly (Figure 1)

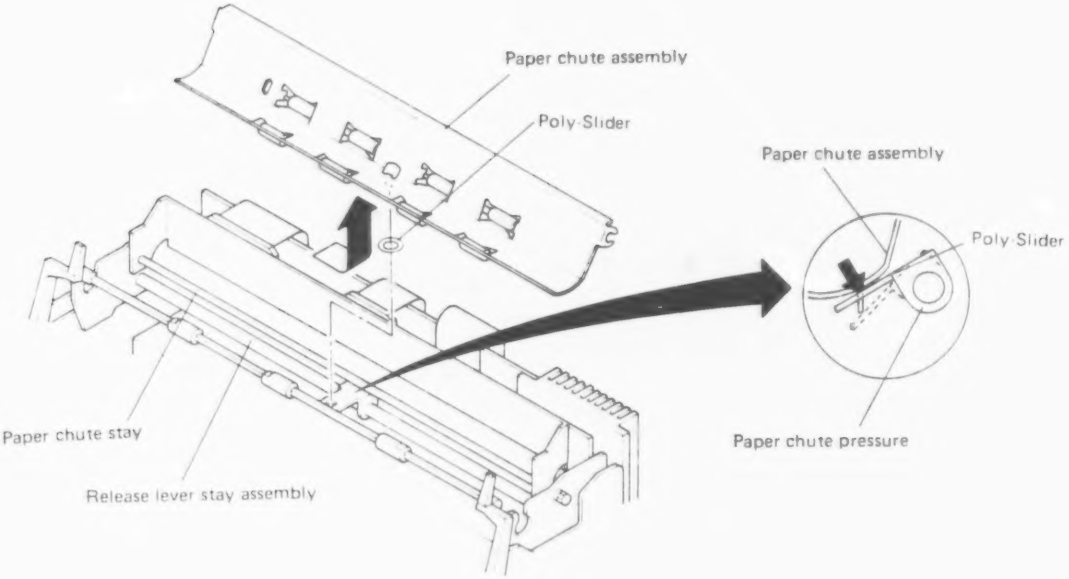
1. Complete any troubleshooting or adjustment that can be finished at this point
2. Replace the paper chute assembly by reversing the removal procedure
3. Sign off your troubleshooting log

   ☐ Have your instructor check your work

4. Clean up area and return tools and equipment to proper storage, or prepare for next job sheet as directed by your instructor

JOB SHEET #15

FIGURE 1


Paper chute assembly
Poly-Slider
Paper chute assembly
Poly-Slider
Paper chute stay
Release lever stay assembly
Paper chute pressure

Courtesy Star Micronics, Inc.

SERVICING AND REPAIRING LETTER-QUALITY PRINTERS
UNIT III

JOB SHEET #16 — REMOVE AND REPLACE THE BAIL ROLLER ASSEMBLY ON A POWERTYPE PRINTER

A. Tools and equipment

1. Printer as selected by instructor
2. *Daisywheel Printer PowerType Technical Manual*
3. Hand tools
4. DVOM
5. Dual-trace oscilloscope
6. Troubleshooting log (from previous job sheets)
7. Replacement parts as required

B. Procedure for removing the bail roller assembly (Figure 1)

(NOTE: The procedures and illustrations in this job sheet are adapted from materials copyrighted ©1984 by Star Micronics, Inc., and are reprinted with permission.)

1. Sign on your troubleshooting log

   (NOTE: The figures that accompany this job sheet are at the end of the job sheet so the separate illustrations can be used more easily in the troubleshooting routine.)

2. Turn the power switch OFF and remove the power cord from the back of the printer
3. Remove the upper case and cover as outlined in a previous job sheet
4. Remove the right and left springs from the paper bail lever
5. Remove the right and left stop rings (E3) on the shaft of the paper bail lever
6. Pull the right side paper bail lever from the bail roller, and then remove the bail roller assembly by pulling it out of the left side paper bail lever

   ☐ Have your instructor check your work

JOB SHEET #16

C. Procedure for replacing the bail roller assembly (Figure 1)

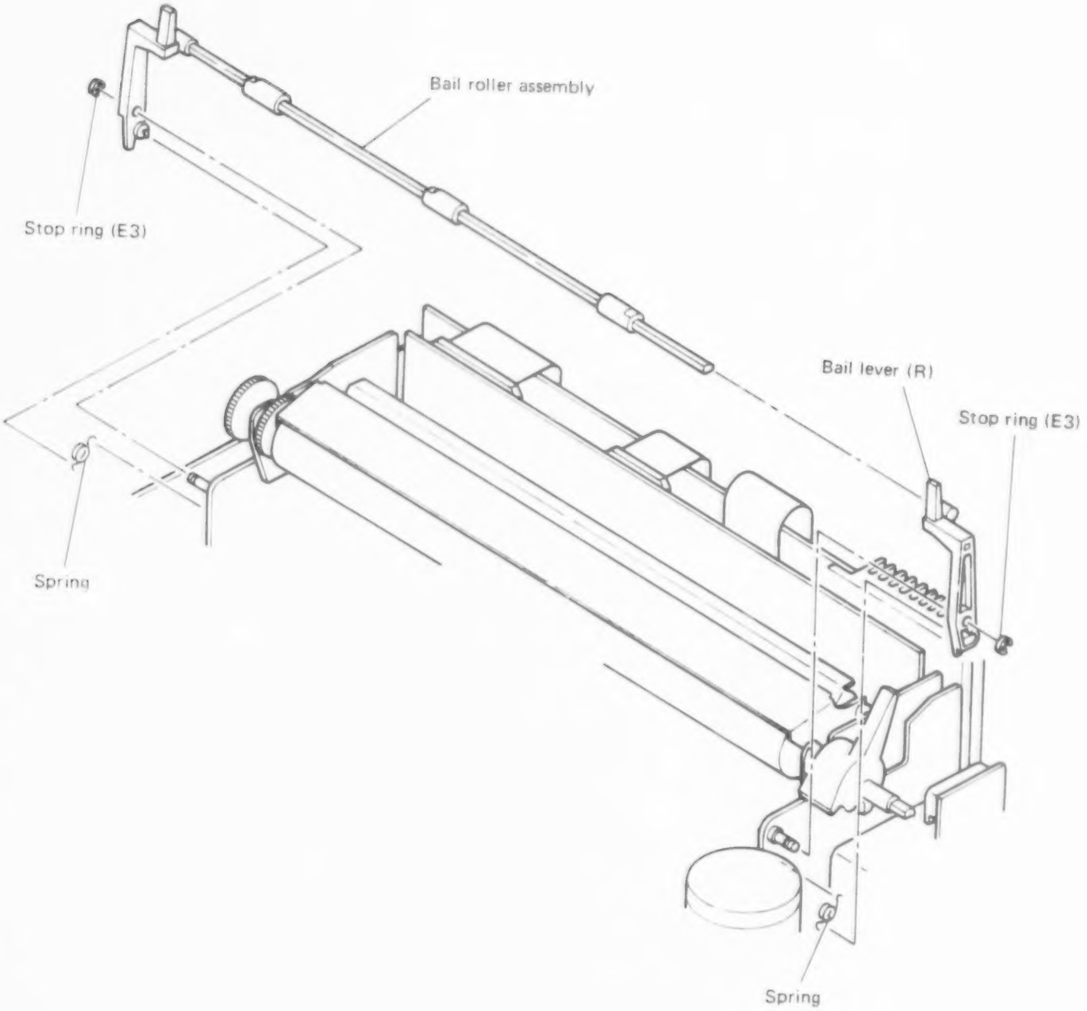
1. Complete all troubleshooting that can be finished at this point
2. Replace the bail roller assembly by reversing the removal procedure
3. Sign off your troubleshooting log

   ☐ Have your instructor check your work

4. Clean up area and return tools and equipment to proper storage, or prepare for next job sheet as directed by your instructor

JOB SHEET #16

FIGURE 1


Bail roller assembly
Stop ring (E3)
Bail lever (R)
Stop ring (E3)
Spring
Spring

Courtesy Star Micronics, Inc.

SERVICING AND REPAIRING LETTER-QUALITY PRINTERS
UNIT III

JOB SHEET #17 — REMOVE AND REPLACE THE TERMINAL BOARD ON A POWERTYPE PRINTER

A. Tools and equipment

1. Printer as selected by instructor
2. *Daisywheel Printer PowerType Technical Manual*
3. Hand tools
4. DVOM
5. Dual-trace oscilloscope
6. Troubleshooting log (from previous job sheets)
7. Replacement parts as required

B. Procedure for removing the terminal board (Figure 1)

(NOTE: The procedures and illustrations in this job sheet are adapted from materials copyrighted © 1984 by Star Micronics, Inc., and are reprinted with permission.)

1. Sign on your troubleshooting log

   (NOTE: The figures that accompany this job sheet are at the end of the job sheet so the separate illustrations can be used more easily in the troubleshooting routine.)

2. Turn the power switch OFF and remove the power cord from the back of the printer
3. Remove the upper case and cover as outlined in a previous job sheet
4. Remove the printer mechanisms as outlined in a previous job sheet
5. Remove the four M3 × 4 screws that secure the ribbon base assembly
6. Remove all connectors on the terminal board
7. Remove the two M3 × 4 screws that secure the terminal board
8. Remove the CN1 connector on the control drive board, the connector that comes from the terminal board

JOB SHEET #17

9. Remove the M3 × 4 screws that hold the cable pressure plates to the frame

10. Remove the two M3 × 5 screws that secure the angle that unites the control drive board and the control logic board to the left and right sides of the frame

11. Remove the two M3 × 5 screws that secure the control drive board to the frame

12. Lift the terminal board up and pull the ribbon cable out of the slot in the cable guide device

☐ Have your instructor check your work

C. Procedure for replacing terminal board (Figure 1)

1. Complete ribbon cable position adjustment at this point

2. Replace the terminal board by reversing the removal procedure

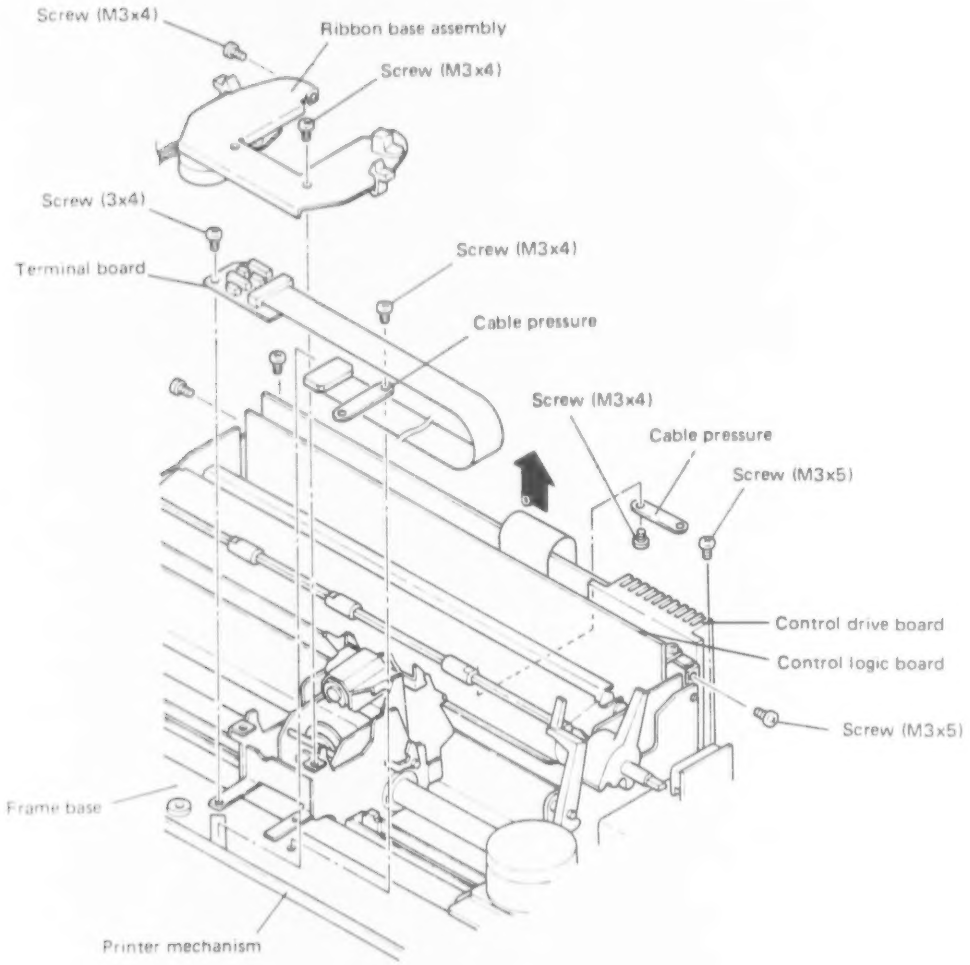
3. Sign off your troubleshooting log

☐ Have your instructor check your work

4. Clean up area and return tools and equipment to proper storage, or prepare for next job sheet as directed by your instructor

JOB SHEET #17

FIGURE 1


Screw (M3x4)
Ribbon base assembly
Screw (M3x4)
Screw (3x4)
Terminal board
Screw (M3x4)
Cable pressure
Screw (M3x4)
Cable pressure
Screw (M3x5)
Control drive board
Control logic board
Screw (M3x5)
Frame base
Printer mechanism

Courtesy Star Micronics, Inc.

SERVICING AND REPAIRING LETTER-QUALITY PRINTERS
UNIT III

JOB SHEET #18 — REMOVE AND REPLACE THE PRINTWHEEL HOME POSITION DETECTOR ON A POWERTYPE PRINTER

A. Tools and equipment

1. Printer as selected by instructor
2. *Daisywheel Printer PowerType Technical Manual*
3. Hand tools
4. DVOM
5. Dual-trace oscilloscope
6. Troubleshooting log (from previous job sheets)
7. Replacement parts as required

B. Procedure for removing the printwheel home position detector (Figure 1)

(NOTE: The procedures and illustrations in this job sheet are adapted from materials copyrighted ©1984 by Star Micronics, Inc., and are reprinted with permission.)

1. Sign on your troubleshooting log

   (NOTE: The figures that accompany this job sheet are at the end of the job sheet so the separate illustrations can be used more easily in the troubleshooting routine.)

2. Turn the power switch OFF and remove the power cord from the back of the printer
3. Remove the upper case and cover as outlined in a previous job sheet
4. Remove the carriage assembly as outlined in a previous job sheet
5. Remove the two (E4) stop rings on the motor holder stay
6. Pull the motor holder stay from the holder frame, and also remove the spacer
7. Hold the carriage assembly so that it is inclined, then pull the frame pin holder out of the guide hole and lift the entire detector assembly up and out
8. Remove the two M3 × 6 screws that secure the home position detector

JOB SHEET #18

☐ Have your instructor check your work

C. Procedure for replacing the printwheel home position detector (Figure 1)

1. Complete all troubleshooting and replace the home position detector, if required

2. Replace the printwheel home position detector by reversing the removal procedure

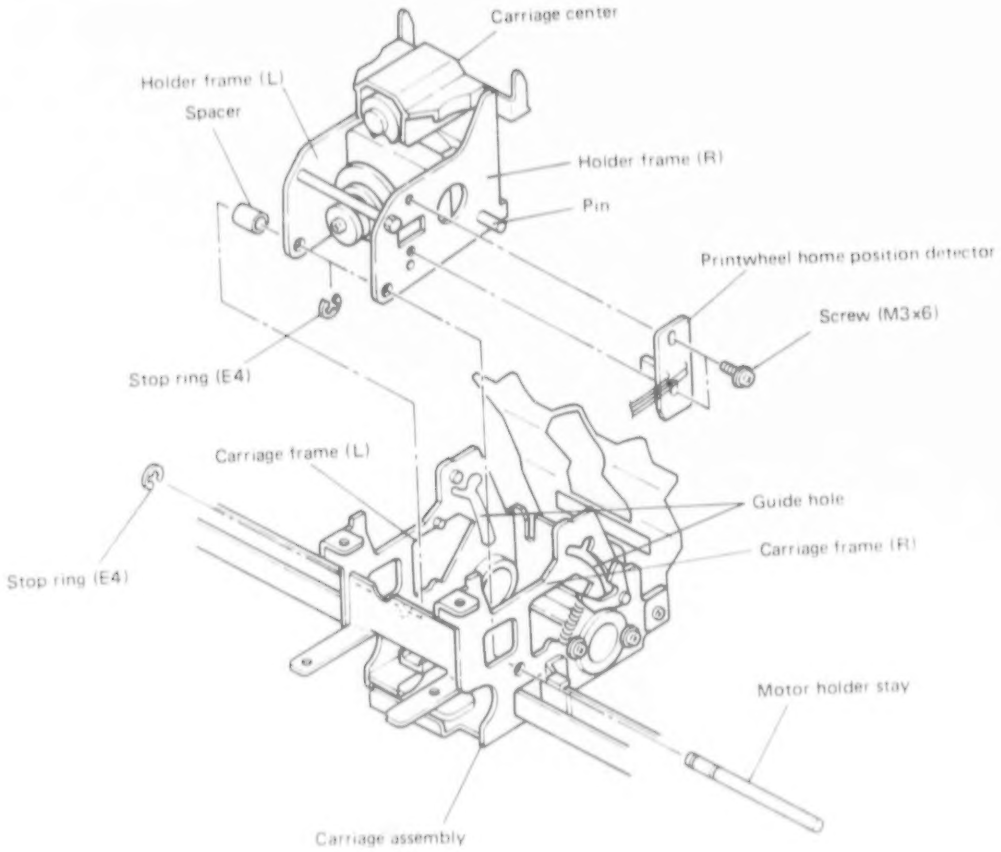
3. Sign off your troubleshooting log

   ☐ Have your instructor check your work

4. Clean up area and return tools and equipment to proper storage, or prepare for next job sheet as directed by your instructor

JOB SHEET #18

FIGURE 1


Carriage center
Holder frame (L)
Spacer
Holder frame (R)
Pin
Printwheel home position detector
Screw (M3×6)
Stop ring (E4)
Carriage frame (L)
Guide hole
Carriage frame (R)
Stop ring (E4)
Motor holder stay
Carriage assembly

Courtesy Star Micronics, Inc.

SERVICING AND REPAIRING LETTER-QUALITY PRINTERS
UNIT III

JOB SHEET #19 — REMOVE AND REPLACE THE CARRIAGE HOME POSITION DETECTOR ON A POWERTYPE PRINTER

A. Tools and equipment

1. Printer as selected by instructor
2. *Daisywheel Printer PowerType Technical Manual*
3. Hand tools
4. DVOM
5. Dual-trace oscilloscope
6. Troubleshooting log (from previous job sheets)
7. Replacement parts as required

B. Procedure for removing the carriage home position detector (Figure 1)

(NOTE: The procedures and illustrations in this job sheet are adapted from materials copyrighted ©1984 by Star Micronics, Inc., and are reprinted with permission.)

1. Sign on your troubleshooting log

   (NOTE: The figures that accompany this job sheet are at the end of the job sheet so the separate illustrations can be used more easily in the troubleshooting routine.)

2. Turn the power switch OFF and remove the power cord from the back of the printer
3. Remove the upper case and cover as outlined in a previous job sheet
4. Remove the printer mechanism as outlined in a previous job sheet
5. Pull the connector out of the CN3 connector on the control logic board
6. Pull the carriage home detector lead lines out of the CN3 connector pins 3 through 6

   (NOTE: Remember the violet, blue, orange, and red order of the lead lines so you can replace them properly.)

7. Remove the M3 × 6 screws that secure the carriage home detector to the frame

JOB SHEET #19

☐ Have your instructor check your work

C. Procedure for replacing the carriage home position detector (Figure 1)

1. Complete all troubleshooting and replace the carriage home position detector, if required

2. Replace the carriage home position detector by reversing the removal procedure

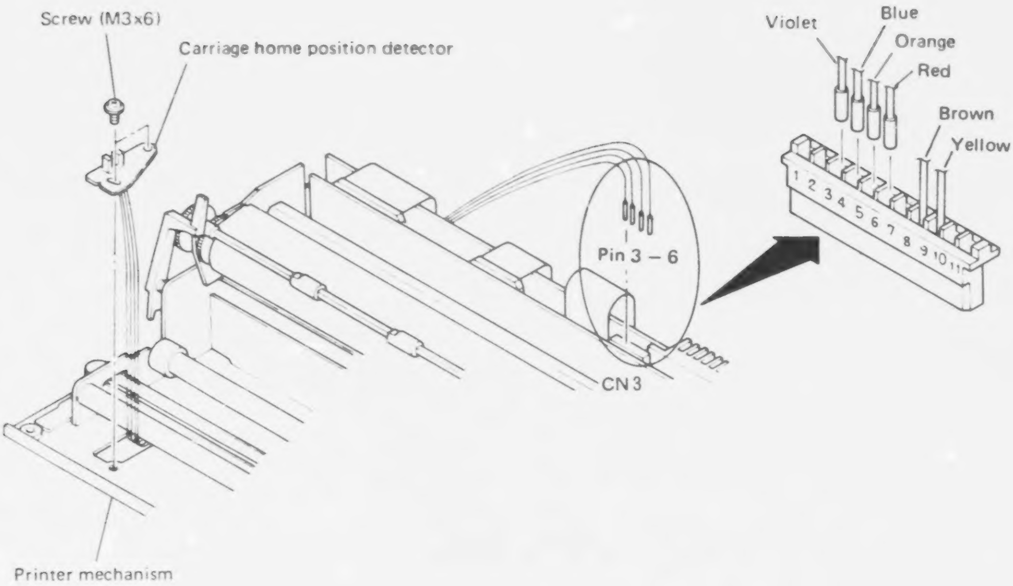
3. Sign off your troubleshooting log

   ☐ Have your instructor check your work

4. Clean up area and return tools and equipment to proper storage, or prepare for next job sheet as directed by your instructor

JOB SHEET #19

FIGURE 1


Screw (M3x6)
Carriage home position detector
Printer mechanism
Pin 3 – 6
CN3
Violet
Blue
Orange
Red
Brown
Yellow
1 2 3 4 5 6 7 8 9 10 11

Courtesy Star Micronics, Inc.

SERVICING AND REPAIRING LETTER-QUALITY PRINTERS
UNIT III

JOB SHEET #20 — REMOVE AND REPLACE THE RIGHT END DETECTOR ON A POWERTYPE PRINTER

A. Tools and equipment

1. Printer as selected by instructor
2. *Daisywheel Printer PowerType Technical Manual*
3. Hand tools
4. DVOM
5. Dual-trace oscilloscope
6. Troubleshooting log (from previous job sheets)
7. Replacement parts as required

B. Procedure for removing the right end detector (Figure 1)

(NOTE: The procedures and illustrations in this job sheet are adapted from materials copyrighted ©1984 by Star Micronics, Inc., and are reprinted with permission.)

1. Sign on your troubleshooting log

   (NOTE: The figures that accompany this job sheet are at the end of the job sheet so the separate illustrations can be used more easily in the troubleshooting routine.)

2. Turn the power switch OFF and remove the power cord from the back of the printer
3. Remove the upper case and cover as outlined in a previous job sheet
4. Pull the connector out of the CN3 connector on the control logic board
5. Pull the right end detector lead lines out of CN3 pins 8 and 9, and remember the brown 8, red 9 order
6. Remove the two M2 × 8 screws that secure the right end detector to the leaf switch base

   ☐ Have your instructor check your work

JOB SHEET #20

C. Procedure for replacing the right end detector (Figure 1)

1. Complete all troubleshooting and replace the right end detector, if required

2. Replace the right end detector by reversing the removal procedure

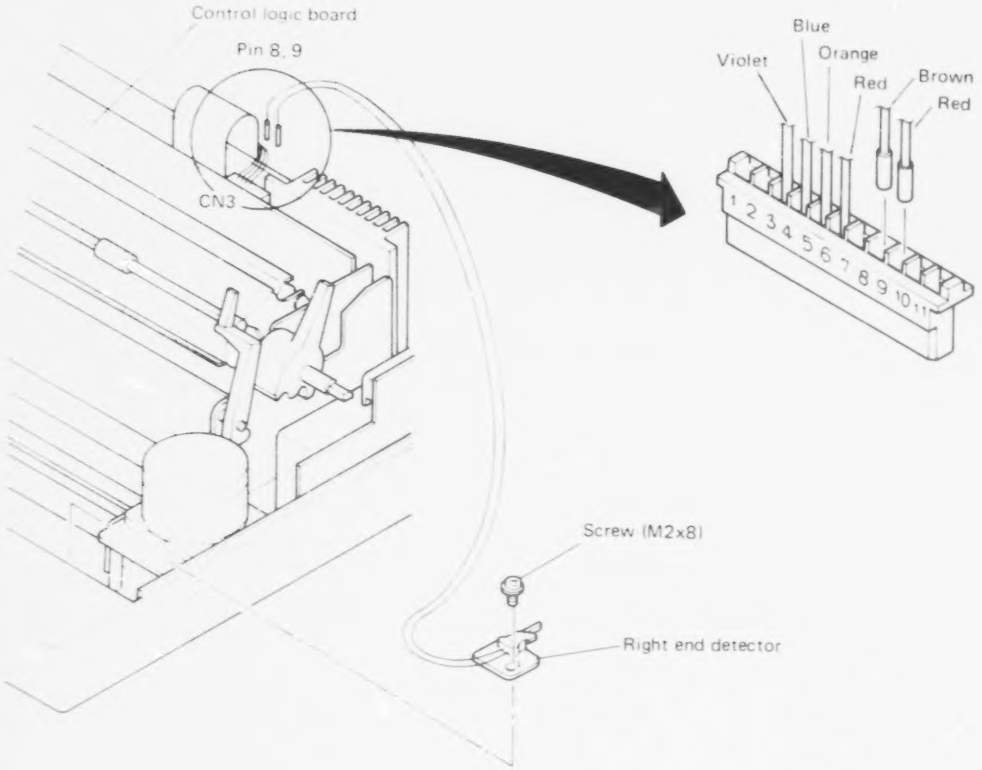
3. Sign off your troubleshooting log

   ☐ Have your instructor check your work

4. Clean up area and return tools and equipment to proper storage, or prepare for next job sheet as directed by your instructor

JOB SHEET #20

FIGURE 1


Control logic board
Pin 8, 9
CN3
Violet
Blue
Orange
Red
Brown
Red
1
2
3
4
5
6
7
8
9
10
11
Screw (M2x8)
Right end detector

Courtesy Star Micronics, Inc.

SERVICING AND REPAIRING LETTER-QUALITY PRINTERS
UNIT III

JOB SHEET #21 — REMOVE AND REPLACE THE RIBBON END DETECTOR ON A POWERTYPE PRINTER

A. Tools and equipment

1. Printer as selected by instructor
2. *Daisywheel Printer PowerType Technical Manual*
3. Hand tools
4. DVOM
5. Dual-trace oscilloscope
6. Troubleshooting log (from previous job sheets)
7. Replacement parts as required

B. Procedure for removing the ribbon end detector (Figure 1)

(NOTE: The procedures and illustrations in this job sheet are adapted from materials copyrighted © 1984 by Star Micronics, Inc., and are reprinted with permission.)

1. Sign on your troubleshooting log

   (NOTE: The figures that accompany this job sheet are at the end of the job sheet so the separate illustrations can be used more easily in the troubleshooting routine.)

2. Turn the power switch OFF and remove the power cord from the back of the printer
3. Remove the upper case and cover as outlined in a previous job sheet
4. Remove the cable that goes from the ribbon end detector to the terminal board (unplug it from the terminal board end)
5. Remove the M3 × 4 screw that secures the ribbon end detector

   ☐ Have your instructor check your work

JOB SHEET #21

C. Procedure for replacing the ribbon end detector (Figure 1)

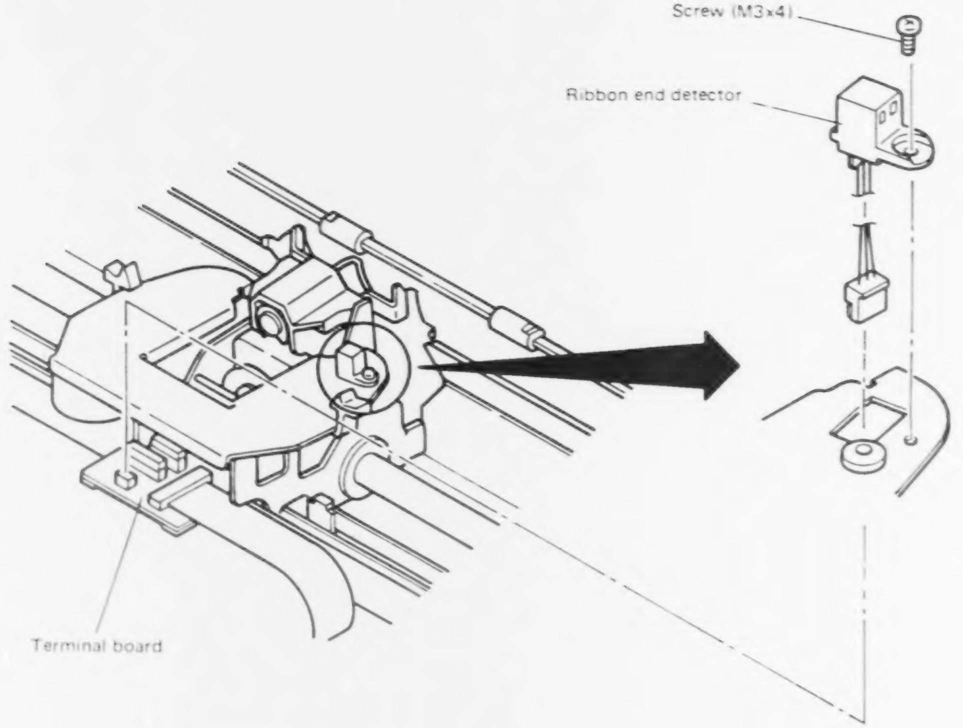
1. Complete all troubleshooting and replace the ribbon end detector, if required
2. Replace the ribbon end detector by reversing the removal procedure
3. Sign off your troubleshooting log

   ☐ Have your instructor check your work

4. Clean up area and return tools and equipment to proper storage, or prepare for next job sheet as directed by your instructor

JOB SHEET #21

FIGURE 1


Screw (M3x4)
Ribbon end detector
Terminal board

Courtesy Star Micronics, Inc.

SERVICING AND REPAIRING LETTER-QUALITY PRINTERS
UNIT III

JOB SHEET #22 — REMOVE AND REPLACE THE PRIMARY AND SECONDARY FUSES ON A POWERTYPE PRINTER

A. Tools and equipment

1. Printer as selected by instructor
2. *Daisywheel Printer PowerType Technical Manual*
3. Hand tools
4. DVOM
5. Dual-trace oscilloscope
6. Troubleshooting log (from previous job sheets)
7. Replacement parts as required

B. Procedure for removing the system fuses (Figure 1)

(NOTE: The procedures and illustrations in this job sheet are adapted from materials copyrighted © 1984 by Star Micronics, Inc., and are reprinted with permission.)

1. Sign on your troubleshooting log

   (NOTE: The figures that accompany this job sheet are at the end of the job sheet so the separate illustrations can be used more easily in the troubleshooting routine.)

2. Turn the power switch OFF and remove the power cord from the back of the printer
3. Remove the upper case and cover as outlined in a previous job sheet
4. Remove the fuse cover on the fuse board near the power switch
5. Check the primary fuse, and replace it if it is bad

   (NOTE: For 120V printers, use a 3A/125V slow-blow type fuse, and for the 220V/240V printers, use a 1.6A slow-blow type fuse

6. Remove the power regulator unit as outlined in a previous job sheet
7. Remove the six M3 × 6 screws that secure the cover to the power regulator unit

JOB SHEET #22

8. Check the secondary fuse at the left of the power regulator unit and replace it if it is bad

   (NOTE: Fuse replacements should be a 3A/125V or a 1.6A/220V/240V, depending on the printer.)

   ☐ Have your instructor check your work

C. Procedure for replacing the system fuses (Figure 1)

1. Check the condition of the primary and secondary fuses in case the POWER lamp does not light when the power switch is turned ON

2. Replace the power regulator unit and the primary fuse by reversing the removal procedure

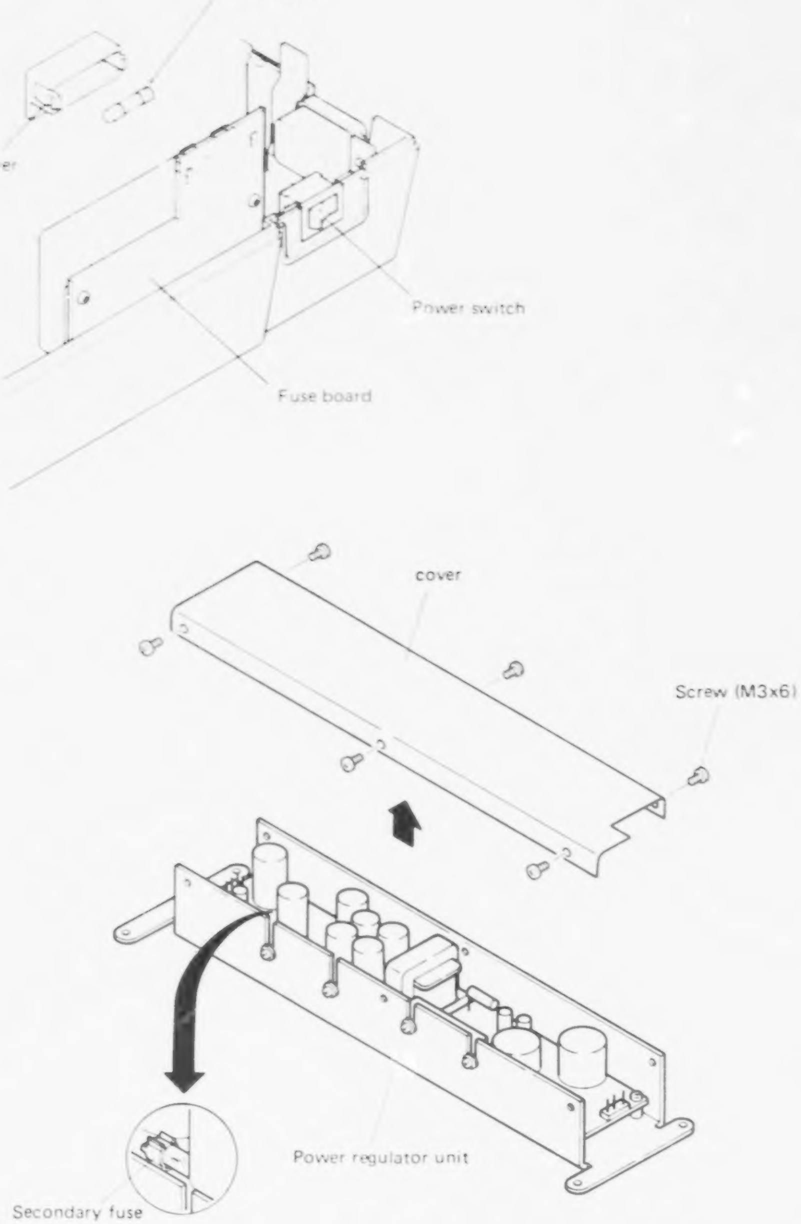
3. Sign off your troubleshooting log

   ☐ Have your instructor check your work

4. Clean up area and return tools and equipment to proper storage, or prepare for next job sheet as directed by your instructor

JOB SHEET #22

FIGURE 1


Primary fuse
Fuse cover
Power switch
Fuse board
cover
Screw (M3x6)
Power regulator unit
Secondary fuse

Courtesy Star Micronics, Inc.

SERVICING AND REPAIRING LETTER-QUALITY PRINTERS
UNIT III

JOB SHEET #23 — MAKE A MUTUAL ADJUSTMENT OF THE HAMMER AND PRINTWHEEL ON A POWERTYPE PRINTER

A. Tools and equipment

1. Printer as selected by instructor
2. *Daisywheel Printer PowerType Technical Manual*
3. Hand tools
4. DVOM
5. Dual-trace oscilloscope
6. Troubleshooting log (from previous job sheets)
7. Replacement parts as required

B. Procedure for adjustment (Figure 1)

(NOTE: The procedures and illustrations in this job sheet are adapted from materials copyrighted © 1984 by Star Micronics, Inc., and are reprinted with permission.)

1. Sign on your troubleshooting log

   (NOTE: The figures that accompany this job sheet are at the end of the job sheet so the separate illustrations can be used more easily in the troubleshooting routine.)

2. Turn the power switch OFF and remove the power cord from the back of the printer
3. Remove the upper case and cover as outlined in a previous job sheet
4. Use a hex wrench to loosen the two M3 × 3 screws that secure the printwheel hub, and then remove the printwheel from the printwheel motor
5. Remove the CN3 connector that connects the carriage motor to the control drive board
6. Move the carriage to the home position at the left side of the printer
7. Turn power ON and check for rotation of the printwheel motor while the carriage is in home position

JOB SHEET #23

8. Move the carriage to the center of the frame and check to see that the printwheel motor stops because it should not rotate when the carriage is in home position
9. Pull the printwheel motor up, and insert the hub of the printwheel onto the printwheel motor shaft
10. Set the space between the hammer top and the printwheel to 1.5mm, and check it with a thickness gauge
11. Move the printwheel into a position so that the center of the "i" character on the printwheel is so aligned with the hammer that the hammer is dead center on the "i"
12. Move the carriage to the left end home position and turn the power OFF
13. Turn the power ON again, and check to make sure that the hammer does come to the center of the "i" when the wheel stops its rotation
14. Tighten the screw that secures the printwheel hub, and apply screw lock to make sure it stays tight
15. Put the printwheel motor in place, turn the power OFF, and insert the CN3 connector back into the control drive board
16. Turn the power ON and run a printer self test

    ☐ Have your instructor check your work

17. Make adjustments for uneven density as required

    (NOTE: This usually means the printwheel is slightly off right or left, so spacing and centering the hammer and the printwheel may have to be repeated.)

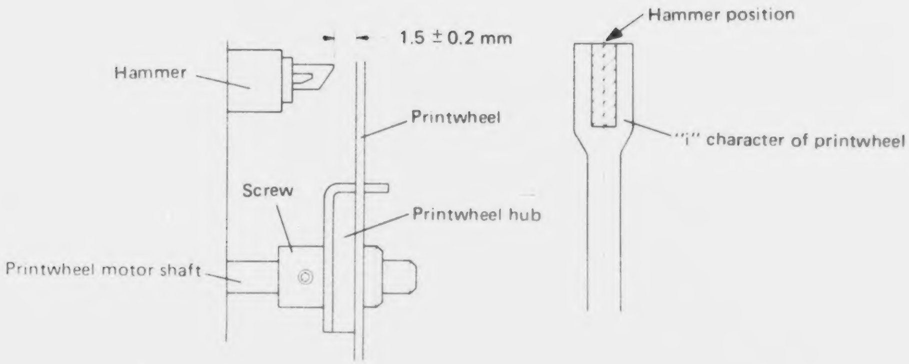
18. Sign off your troubleshooting log

    ☐ Have your instructor check your work

19. Clean up area and return tools and equipment to proper storage, or prepare for next job sheet as directed by your instructor

JOB SHEET #23

FIGURE 1


Hammer position
1.5 ± 0.2 mm
Hammer
Printwheel
"i" character of printwheel
Screw
Printwheel hub
Printwheel motor shaft

Courtesy Star Micronics, Inc.

SERVICING AND REPAIRING LETTER-QUALITY PRINTERS
UNIT III

JOB SHEET #24 — MAKE A POSITION ADJUSTMENT OF THE PRINTWHEEL HOME POSITION DETECTOR ON A POWERTYPE PRINTER

A. Tools and equipment

1. Printer as selected by instructor
2. *Daisywheel Printer PowerType Technical Manual*
3. Hand tools
4. DVOM
5. Dual-trace oscilloscope
6. Troubleshooting log (from previous job sheets)
7. Replacement parts as required

B. Procedure for adjustment (Figure 1)

(NOTE: The procedures and illustrations in this job sheet are adapted from materials copyrighted © 1984 by Star Micronics, Inc., and are reprinted with permission.)

1. Sign on your troubleshooting log

   (NOTE: The figures that accompany this job sheet are at the end of the job sheet so the separate illustrations can be used more easily in the troubleshooting routine.)

2. Turn the power switch OFF and remove the power cord from the back of the printer
3. Remove the upper case and cover as outlined in a previous job sheet
4. Set your dual-trace oscilloscope as indicated in the chart and illustration in Figure 1
5. Turn power ON and begin pressing the control panel's TOF and FF buttons simultaneously so the printwheel motor will keep rotating at the carriage home position
6. Check the waveforms on the oscilloscope screen to see if they do or do not correspond to the waveforms illustrated in Figure 1
7. Adjust the printwheel home position detect signal rise (indicated by E) by raising or lowering the printwheel home position detect board at the carriage side

JOB SHEET #24

8. Free the detect board for adjustment by loosening the two M3 × 6 screws that secure it

9. Set the rise (E) position to the A-D positions (2.15 ms, ± 0.4 ms) from the rise or fall of the printwheel excitation waveforms as illustrated in Figure 1

10. Apply screw lock to the detect board screws to assure that they will stay tight

11. Turn power OFF and reassemble printer

12. Turn power ON and run a printer self test

    ☐ Have your instructor check your work

13. Make further adjustments as required

14. Sign off your troubleshooting log

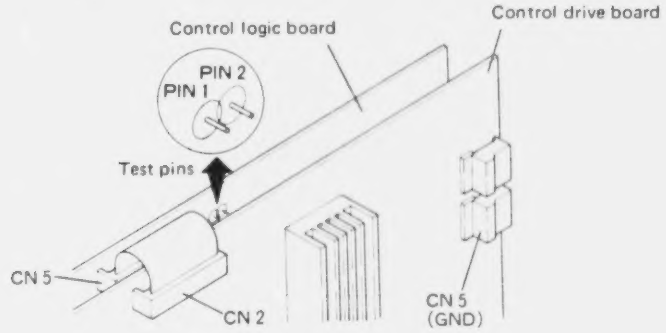
    ☐ Have your instructor check your work

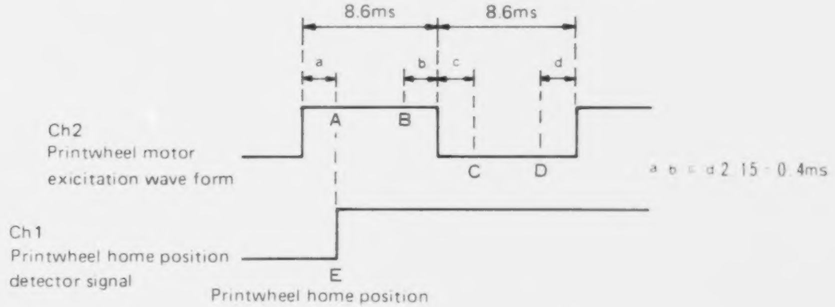
15. Clean up area and return tools and equipment to proper storage, or prepare for next job sheet as directed by your instructor

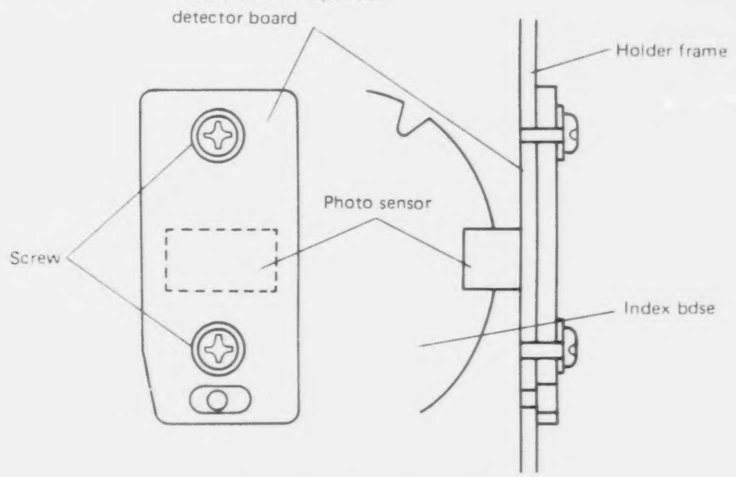
JOB SHEET #24

FIGURE 1

Oscilloscope	Test pin	Board
Ch 1	PIN1 or CN5's pin 1	Control logic board
Ch 2	PIN2 or CN5's pin 13	Control logic board
GND	GND	Control drive board


Control logic board
Control drive board
PIN 2
PIN 1
Test pins
CN 5
CN 2
CN 5
(GND)


8.6ms
8.6ms
a
b
c
d
A
B
C
D
E
Ch2
Printwheel motor
excitation wave form
Ch1
Printwheel home position
detector signal
a = b = c = d 2.15 ± 0.4ms


Printwheel home position
detector board
Holder frame
Photo sensor
Screw
Index bdse

Courtesy Star Micronics, Inc.

SERVICING AND REPAIRING LETTER-QUALITY PRINTERS
UNIT III

JOB SHEET #25 — ADJUST THE PLATEN POSITION, GEAR BACKLASH, AND PAPER PRESSURE/PLATEN GAP ON A POWERTYPE PRINTER

A. Tools and equipment

1. Printer as selected by instructor
2. *Daisywheel Printer PowerType Technical Manual*
3. Hand tools
4. DVOM
5. Dual-trace oscilloscope
6. Troubleshooting log (from previous job sheets)
7. Replacement parts as required

B. Procedure for adjusting the platen position (Figure 1)

(NOTE: The procedures and illustrations in this job sheet are adapted from materials copyrighted © 1984 by Star Micronics, Inc., and are reprinted with permission.)

1. Sign on your troubleshooting log

   (NOTE: The figures that accompany this job sheet are at the end of the job sheet so the separate illustrations can be used more easily in the troubleshooting routine.)

2. Turn the power switch OFF and remove the power cord from the back of the printer
3. Remove the upper case and cover as outlined in a previous job sheet
4. Bend the ribbon guide forward slightly to give the platen freedom to move forward
5. Loosen the left and right screws on the printer frame just to the lower right of the adjustment bolt
6. Loosen the adjustment bolts on the right and left sides of the frame so that the adjust collar can be rotated with a wrench
7. Loosen the two M3 × 6 screws that secure the idler base to the sub frame
8. Adjust the gap between the hammer and the platen by rotating the adjust collar (rear) only

   (NOTE: The adjustment screw is for front/back adjustment.)

JOB SHEET #25

9. Use a thickness gauge to adjust the platen/hammer gap to 5.65 mm, ± 0.1mm

10. Check the gap by inserting a 5.55 mm stopper gauge into the gap, and if it can be inserted the gap is probably right, but double check by trying to insert a 5.75 mm stopper gauge into the gap, and if it will not go, then the gap is correct

11. Check the adjustment at both the right and left ends of the platen

    ☐ Have your instructor check your work

C. Procedure for checking the platen up/down adjustment

1. Connect the printer to a host microcomputer, turn both the micro and the printer ON, and then print the figure "H" in all columns

2. Check for print that is too light or thin on the upper part of the character, and if it is, turn the front adjustment collar on the left side of the frame slightly to the left, and turn the right side front adjustment collar to the right

3. Check for print that is too light or thin on the lower part of the character, and if it is, turn the front adjustment collar on the left side of the frame slightly to the right, and turn the right side front adjustment collar to the left

4. Print enough columns to assure that print quality is good and that density through the "H" characters is uniform

5. Turn the power OFF

6. Secure the adjustment bolts front and rear on both sides of the frame, and make sure the adjustment collars do not turn

    (NOTE: Normally the screws securing the idler base would be tightened next, but leave them loose for now, and continue with the next part of this routine.)

    ☐ Have your instructor check your work

D. Procedure for adjusting idler gear backlash (Figure 2)

(NOTE: This adjustment must always be made after the idler base screws have been loosened for the platen position adjustment.)

1. Use a thickness gauge to adjust the backlash of the gear to 64 × 0.5, and to adjust the backlash of the engaging gear to 63 × 0.5

2. Adjust the idler gear itself to as small a backlash as you can get (approximately 0.05 mm)

3. Tighten the screws securing the idler base, and put screw lock on them to make sure they stay tight

JOB SHEET #25

☐ Have your instructor check your work

E. Procedure for adjusting the gap between paper pressure and platen (Figure 3)

(NOTE: This adjustment must also be made after the platen position has been adjusted.)

1. Loosen the two M3 × 6 screws that secure the paper pressure arm
2. Remove the printwheel (as previously outlined) and pull up the printwheel motor section
3. Push the paper pressure arm and the platen together, and move the paper pressure arm up and down as needed so that the curve of the pressure paper arm fits neatly around the platen
4. Tighten the screws that secure the paper pressure arm in position
5. Bend the paper pressure arm forward so that the point where it is even with the mid-point of the platen (c) is approximately 10 to 14 mm away from the platen
6. Put the printwheel motor selection back down in place
7. Adjust the ribbon guides (a) (b) with pliers and a thickness gauge so that the space between paper pressure arm and the platen is reduced to about 0.4 mm to 0.6 mm
8. Check to make sure that the paper pressure arm and the ribbon printwheel do not contact each other
9. Tighten the screws that secure the paper pressure arm right and left, and put screw lock on them to make sure they stay tight
10. Reassemble printer, turn printer ON, and run a printer self test

    ☐ Have your instructor check your work

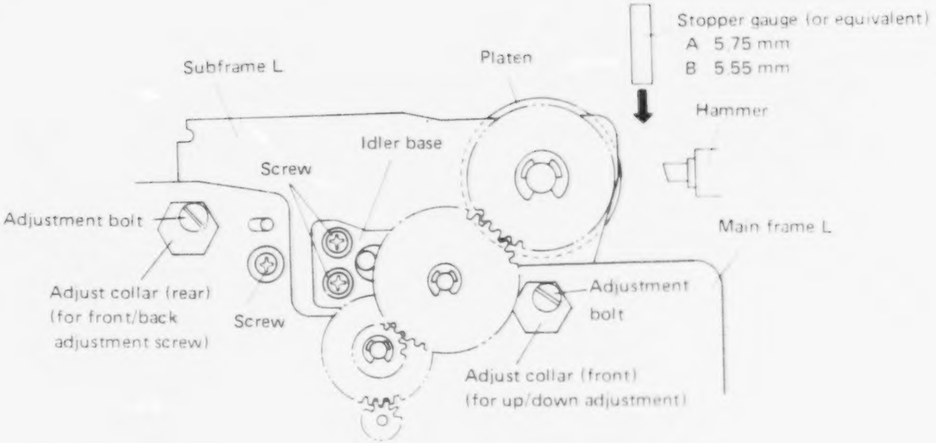
11. Make adjustments as required
12. Sign off your troubleshooting log

    ☐ Have your instructor check your work

13. Clean up area and return tools and equipment to proper storage, or prepare for next job sheet as directed by your instructor

JOB SHEET #25

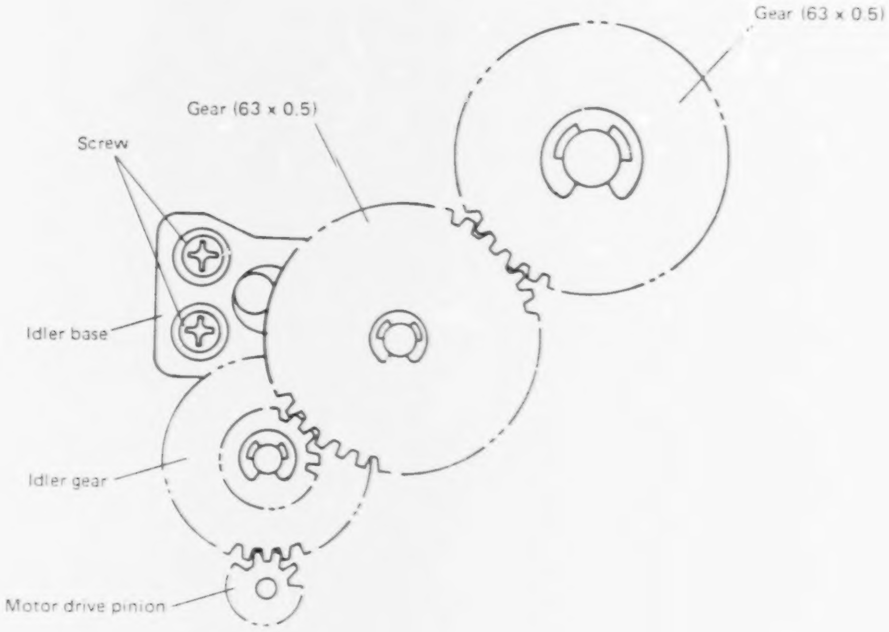
FIGURE 1


Stopper gauge (or equivalent)
A 5.75 mm
B 5.55 mm
Subframe L
Platen
Hammer
Idler base
Screw
Adjustment bolt
Main frame L
Adjust collar (rear)
(for front/back
adjustment screw)
Screw
Adjustment
bolt
Adjust collar (front)
(for up/down adjustment)

Courtesy Star Micronics, Inc.

JOB SHEET #25

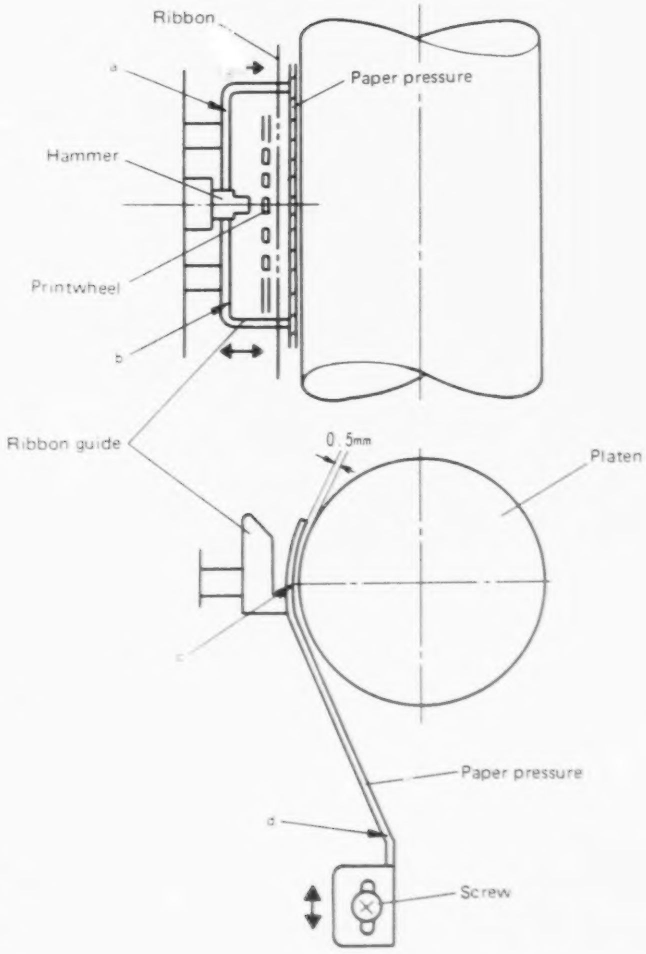
FIGURE 2


Gear (63 x 0.5)
Gear (63 x 0.5)
Screw
Idler base
Idler gear
Motor drive pinion

Courtesy Star Micronics, Inc.

JOB SHEET #25

FIGURE 3


Ribbon
a
Paper pressure
Hammer
Printwheel
b
Ribbon guide
0.5mm
Platen
c
Paper pressure
d
Screw

Courtesy Star Micronics, Inc.

SERVICING AND REPAIRING LETTER-QUALITY PRINTERS
UNIT III

JOB SHEET #26 — ADJUST THE TIMING BELT TENSION ON A POWERTYPE PRINTER

A. Tools and equipment

1. Printer as selected by instructor
2. *Daisywheel Printer PowerType Technical Manual*
3. Hand tools
4. DVOM
5. Dual-trace oscilloscope
6. Troubleshooting log (from previous job sheets)
7. Replacement parts as required

B. Procedure for adjustment (Figure 1)

(NOTE: The procedures and illustrations in this job sheet are adapted from materials copyrighted © 1984 by Star Micronics, Inc., and are reprinted with permission.)

1. Sign on your troubleshooting log

   (NOTE: The figures that accompany this job sheet are at the end of the job sheet so the separate illustrations can be used more easily in the troubleshooting routine.)

2. Turn the power switch OFF and remove the power cord from the back of the printer
3. Remove the upper case and cover as outlined in a previous job sheet
4. Move the carriage to the right
5. Loosen the two M3 × 6 screws that secure the pulley tension lever
6. Locate the rubber foot in the center of the frame because this will become a reference point for making the belt adjustment
7. Use pliers in the pulley tension lever hole (a) and the frame base hole (b) to pull the belt in the direction needed to get a tension of 34 to 40 g as the belt is pushed in a distance of 1.5 mm at the point of the rubber foot at center frame

JOB SHEET #26

8. Tighten the screws that secure the pulley tension lever

9. Move the carriage right and left a few times to make sure the tension is proper, and make whatever adjustments are required

10. Place screw lock on the screws to make sure they stay tight

11. Reassemble the printer, turn the power ON, and run a printer self test

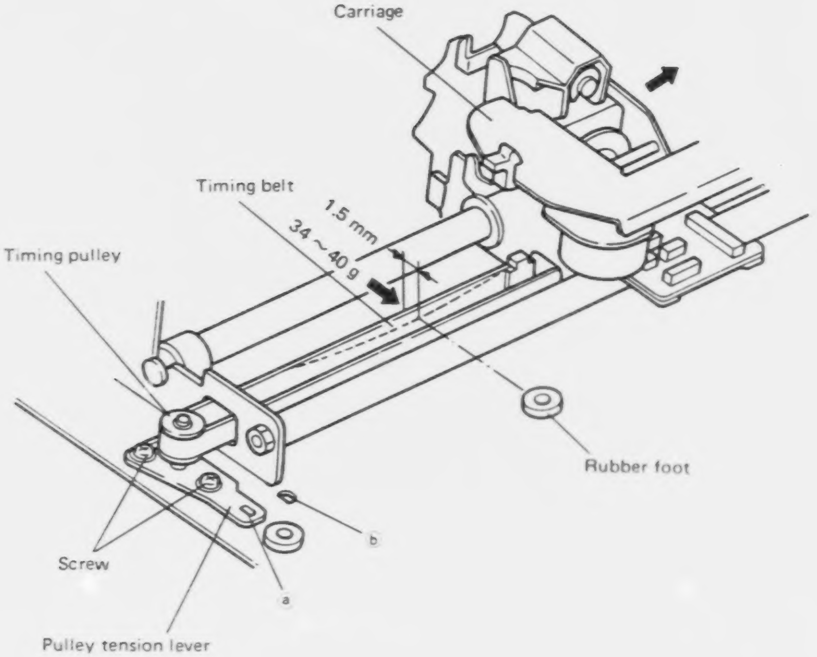
    ☐ Have your instructor check your work

12. Sign off your troubleshooting log

13. Clean up area and return tools and equipment to proper storage, or prepare for next job sheet as directed by your instructor

JOB SHEET #26

FIGURE 1


Carriage
Timing belt
1.5 mm
34 ~ 40 g
Timing pulley
Rubber foot
b
Screw
a
Pulley tension lever

Courtesy Star Micronics, Inc.

SERVICING AND REPAIRING LETTER-QUALITY PRINTERS
UNIT III

JOB SHEET #27 — ADJUST THE CARRIAGE HOME POSITION DETECTOR ON A POWERTYPE PRINTER

A. Tools and equipment

1. Printer as selected by instructor
2. *Daisywheel Printer PowerType Technical Manual*
3. Hand tools
4. DVOM
5. Dual-trace oscilloscope
6. Troubleshooting log (from previous job sheets)
7. Replacement parts as required

B. Procedure for adjustment (Figure 1)

(NOTE: The procedures and illustrations in this job sheet are adapted from materials copyrighted ©1984 by Star Micronics, Inc., and are reprinted with permission.)

1. Sign on your troubleshooting log

   (NOTE: The figures that accompany this job sheet are at the end of the job sheet so the separate illustrations can be used more easily in the troubleshooting routine.)

2. Turn the power switch OFF and remove the power cord from the back of the printer
3. Remove the upper case and cover as outlined in a previous job sheet
4. Check to see if the first column of printing is set halfway between 0 and 1 on the first measure of the paper bail lever shaft, and continue if adjust is required

   (NOTE: This is the way the printer is set when shipped, so anytime it is not at this setting, this adjustment should be made.)

5. Loosen the screw that secures the carriage home detector
6. Move the board right or left for the required distance to align the carriage home position detector exactly halfway between the 0 and 1 on the first measure

JOB SHEET #27

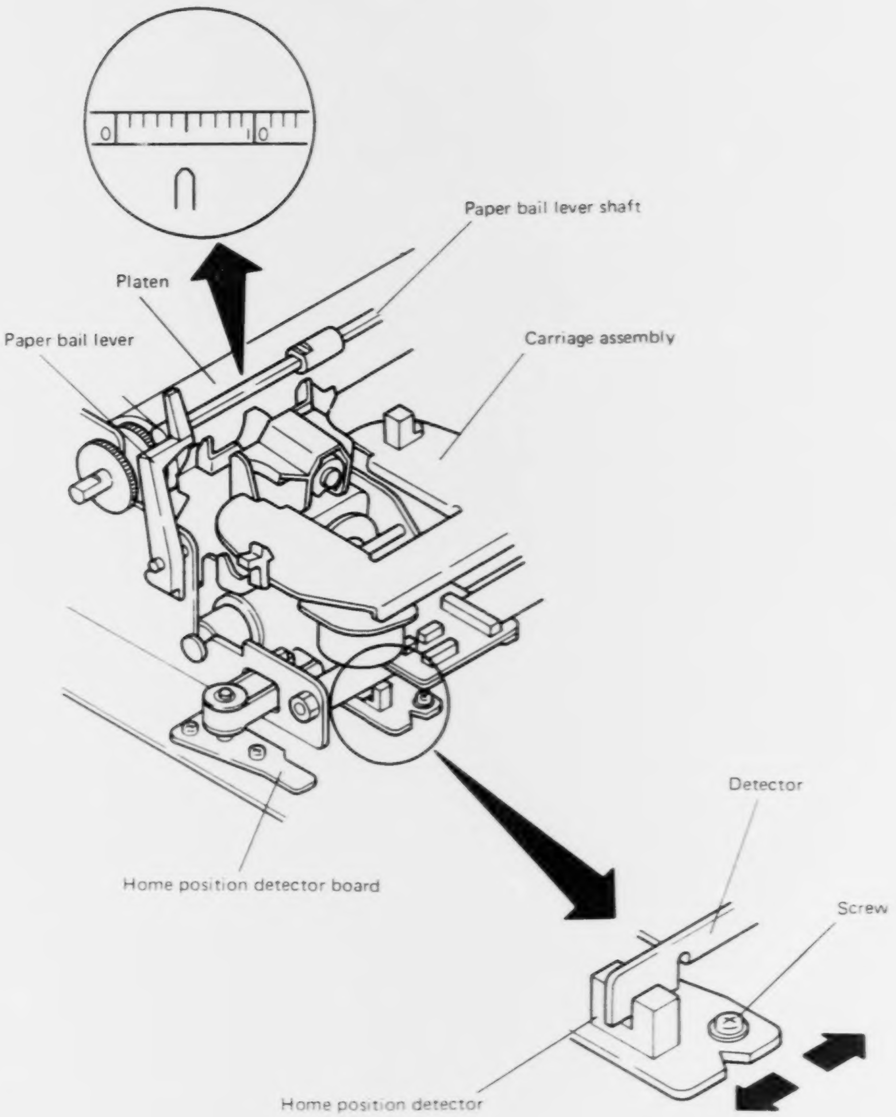
7. Move the board right if the character is shifted to the left of home position, and move the board left if the character is shifted to the right of home position
8. Tighten the screw that secures the detector board
9. Reassemble printer, turn power ON, and run a printer self test

   ☐ Have your instructor check your work

10. Clean up area and return tools and equipment to proper storage, or prepare for next job sheet as directed by your instructor

JOB SHEET #27

FIGURE 1


0
10
Paper bail lever shaft
Platen
Paper bail lever
Carriage assembly
Home position detector board
Detector
Screw
Home position detector

Courtesy Star Micronics, Inc.

SERVICING AND REPAIRING LETTER-QUALITY PRINTERS
UNIT III

JOB SHEET #28 — ADJUST THE CARRIAGE RIGHT END DETECTOR ON A POWERTYPE PRINTER

A. Tools and equipment

1. Printer as selected by instructor
2. *Daisywheel Printer PowerType Technical Manual*
3. Hand tools
4. DVOM
5. Dual-trace oscilloscope
6. Troubleshooting log (from previous job sheets)
7. Replacement parts as required

B. Procedure for adjustment (Figure 1)

(NOTE: The procedures and illustrations in this job sheet are adapted from materials copyrighted © 1984 by Star Micronics, Inc., and are reprinted with permission.)

1. Sign on your troubleshooting log

   (NOTE: The figures that accompany this job sheet are at the end of the job sheet so the separate illustrations can be used more easily in the troubleshooting routine.)

2. Turn the power switch OFF and remove the power cord from the back of the printer
3. Remove the upper case and cover as outlined in a previous job sheet
4. Test the carriage right end detector as follows:
   a. Move the carriage to the position where it hits the carriage stopper, and this should turn the right end detector ON
   b. Move the carriage about 1 to 2 mm back left from the carriage stopper, and this should turn the carriage detector OFF
   c. If conditions a. and b. above are not satisfied, then adjustment is required, so continue with the routine

JOB SHEET #28

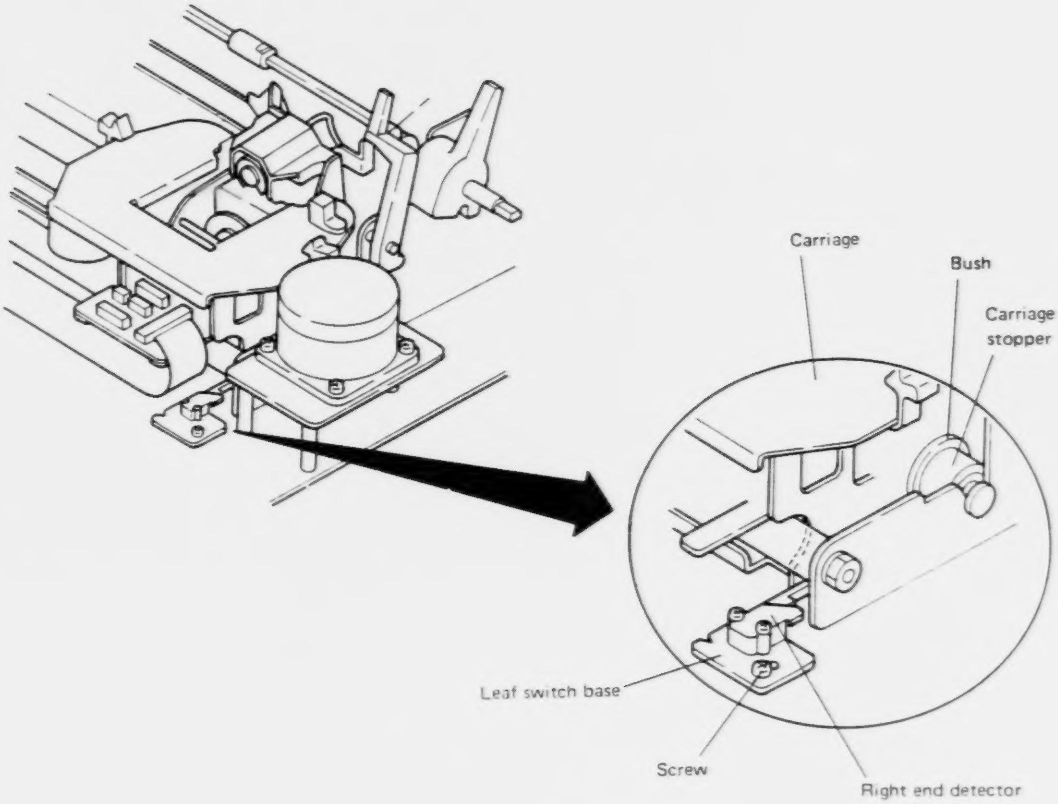
5. Unplug the connector that goes from the carriage to CN3 on the control drive board
6. Loosen the screw that secures the leaf switch base
7. Move the carriage to the right and insert a 0.5 mm thickness gauge between the carriage bushing and the carriage stopper, and then turn the power ON
8. Rotate the leaf switch base to the left, and when the right end detector alarm buzzes, tighten the leaf switch base screw at that point
9. Move the carriage to the left and turn the power OFF
10. Turn the power ON again, insert a 1.5 mm thickness gauge between the carriage bushing and the carriage stopper, then move the carriage to the far right and check to see that the end detector alarm does not sound
11. Apply screw lock to the leaf switch base screw
12. Reassemble the printer and run a printer self test
13. Sign off your troubleshooting log

    ☐ Have your instructor check your work

14. Clean up area and return tools and equipment to proper storage, or prepare for next job sheet as directed by your instructor

JOB SHEET #28

FIGURE 1


Carriage
Bush
Carriage stopper
Leaf switch base
Screw
Right end detector

Courtesy Star Micronics, Inc.

SERVICING AND REPAIRING LETTER-QUALITY PRINTERS
UNIT III

JOB SHEET #29 — ADJUST THE RIBBON CABLE ON A POWERTYPE PRINTER

A. Tools and equipment

1. Printer as selected by instructor
2. *Daisywheel Printer PowerType Technical Manual*
3. Hand tools
4. DVOM
5. Dual-trace oscilloscope
6. Troubleshooting log (from previous job sheets)
7. Replacement parts as required

B. Procedure for adjustment (Figure 1)

(NOTE: The procedures and illustrations in this job sheet are adapted from materials copyrighted © 1984 by Star Micronics, Inc., and are reprinted with permission.)

1. Sign on your troubleshooting log

   (NOTE: The figures that accompany this job sheet are at the end of the job sheet so the separate illustrations can be used more easily in the troubleshooting routine.)

2. Turn the power switch OFF and remove the power cord from the back of the printer
3. Remove the upper case and cover as outlined in a previous job sheet
4. Remove the terminal board as outlined in a previous job sheet
5. Loosen the two screws that secure the cable-holding pressure plate to the frame
6. Check to make sure that the cable pressure plate is 195 mm, ± 5 mm from the end of the terminal board
7. Check to make sure the ribbon cable is in the center of the pressure plate, then tighten the screws that secure the pressure plate
8. Replace the terminal board

JOB SHEET #29

9. Move the carriage left and right to make sure the ribbon cable does not stretch when the carriage is at the left end and that it does not contact the right end detector when the carriage is moved to the far right

10. Check to see if the ribbon cable bends naturally

11. Determine that the adjustment is proper, then apply screw lock to the cable pressure plate screws

12. Reassemble the printer, turn the power ON, and run a printer self test

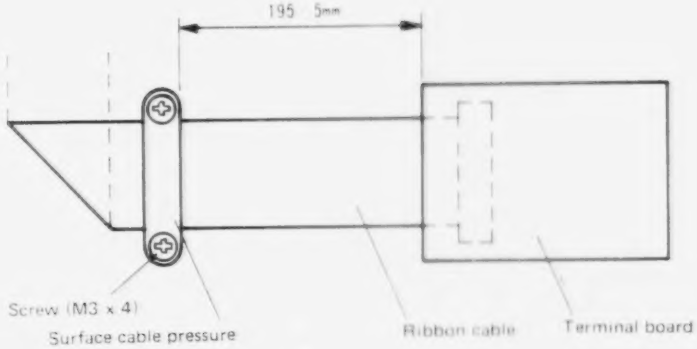
    ☐ Have your instructor check your work

13. Sign off your troubleshooting log

14. Clean up area and return tools and equipment to proper storage, or prepare for next job sheet as directed by your instructor

JOB SHEET #29

FIGURE 1


195 5mm
Screw (M3 x 4)
Surface cable pressure
Ribbon cable
Terminal board

Courtesy Star Micronics, Inc.

SERVICING AND REPAIRING LETTER-QUALITY PRINTERS
UNIT III

JOB SHEET #30 — ADJUST THE POWER SUPPLY VOLTAGE ON A POWERTYPE PRINTER

A. Tools and equipment

1. Printer as selected by instructor
2. *Daisywheel Printer PowerType Technical Manual*
3. Hand tools
4. DVOM
5. Dual-trace oscilloscope
6. Troubleshooting log (from previous job sheets)
7. Replacement parts as required

B. Procedure for adjustment (Figure 1)

(NOTE: The procedures and illustrations in this job sheet are adapted from materials copyrighted © 1984 by Star Micronics, Inc., and are reprinted with permission.)

1. Sign on your troubleshooting log

   (NOTE: The figures that accompany this job sheet are at the end of the job sheet so the separate illustrations can be used more easily in the troubleshooting routine.)

2. Turn the power switch OFF and remove the power cord from the back of the printer
3. Remove the upper case and cover as outlined in a previous job sheet
4. Remove the cover on the power regulator unit as outlined in a previous job sheet
5. Remove CN2 at the end of the secondary board to create a no load condition
6. Connect the positive lead of the DVOM to pin 1 of CN2, and then place the negative lead to pin 6 or 7 on CN2
7. Turn the power ON, and adjust the volume at VR1 by turning up or down until you get a reading of 26.5V
8. Turn the power OFF, reassemble the printer, then turn the power ON and run a printer self test

   ☐ Have your instructor check your work

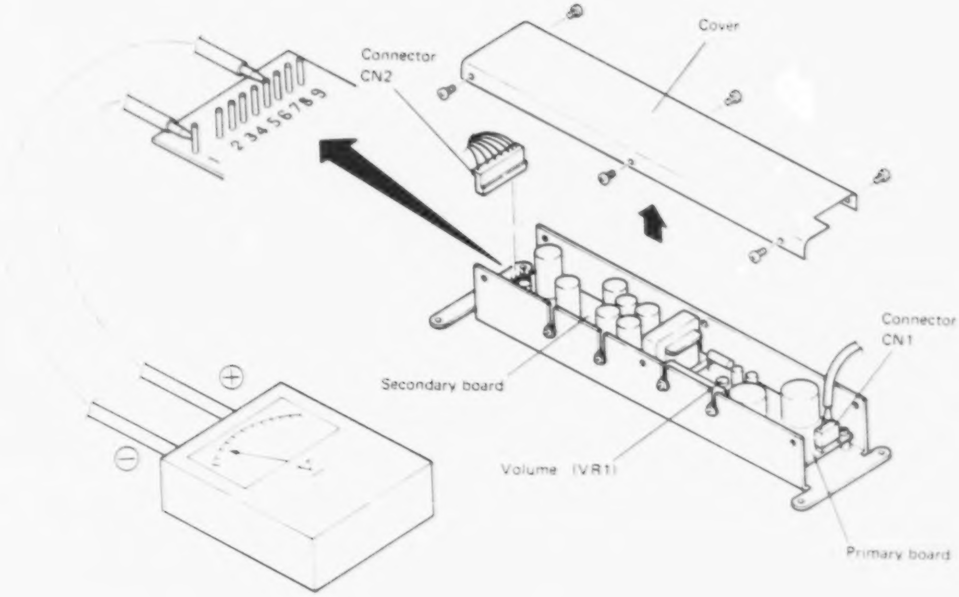
JOB SHEET #30

9. Sign off your troubleshooting log

10. Clean up area and return tools and equipment to proper storage, or prepare for next job sheet as directed by your instructor

JOB SHEET #30

FIGURE 1


Connector CN2
Cover
1 2 3 4 5 6 7 8 9
⊕
⊖
Connector CN1
Secondary board
Volume (VR1)
Primary board

Courtesy Star Micronics, Inc.

SERVICING AND REPAIRING LETTER-QUALITY PRINTERS
UNIT III

JOB SHEET #31 — TROUBLESHOOT A POWERTYPE PRINTER FOR CONTROL PROBLEMS

A. Tools and equipment

1. Printer as selected by instructor
2. *Daisywheel Printer PowerType Technical Manual*
3. Hand tools
4. DVOM
5. Dual-trace oscilloscope
6. Troubleshooting log (from previous job sheets)
7. Replacement parts as required

B. Procedure for adjustment (Figure 1)

(NOTE: The procedures and illustrations in this job sheet are adapted from materials copyrighted © 1984 by Star Micronics, Inc., and are reprinted with permission.)

1. Sign on your troubleshooting log and turn printer OFF
2. Check the ink ribbon cassette to make sure it is okay
3. Place test paper in the printer and move the carriage to the center of the printer
4. Turn the printer power ON
5. Check to see if the carriage moves to the left and stops at the home position
    a. If it does, move on to the next checkpoint
    b. If it doesn't, complete the carriage control ① troubleshooting routine outlined in Figure 3

    (NOTE: The troubleshooting routines that accompany this master job sheet are presented in the form of troubleshooting trees and should be used as required with the schematics in Figures 1 and 2.)
6. Check to see if the printwheel rotated and stopped at the home position
    a. If it did, move on to the next checkpoint
    b. If it didn't, complete the wheel control ① troubleshooting routine outlined in Figure 4

JOB SHEET #31

7. Check to see if the control panel lamp indicators are the same as indicated in the following table:

Name of LED	PM Mode	WP Mode
ON LINE	ON	ON
STATUS PM	ON	OFF
STATUS WP	OFF	ON
RE	OFF	OFF
BUSY	OFF	OFF
POWER	ON	ON

   a. If they are okay, move on to the next checkpoint

   b. If they are improperly lit, complete the control panel troubleshooting routine outlined in Figure 5

8. Check to see if the paper feed motor is stationary

   a. If it is, move on to the next checkpoint

   b. If it isn't, complete the paper feed control troubleshooting routine outlined in Figure 6

9. Check to see if the ribbon feed motor is stationary

   a. If it is, move on to the next checkpoint

   b. If it isn't, complete the ribbon control troubleshooting routine outlined in Figure 7

10. Check to see if the hammer is operating properly

   a. If it is, move on to the next checkpoint

   b. If it isn't, complete the hammer control troubleshooting routine outlined in Figure 8

11. Listen for the presence of abnormal noise as the printer operates

   a. If there if no abnormal noise, turn the printer OFF, and prepare for interface testing

   b. If there is noise, complete the abnormal noise troubleshooting routine in Figure 9

☐ Have your instructor check your work

JOB SHEET #31

C. Procedure for interface testing

1. Turn the printer OFF
2. Make sure interface cable is properly connected to both the host microcomputer and the printer
3. Check DIP switches to make sure they are properly set for parallel or serial transmission in keeping with cable and connector design
4. Turn power ON in the proper order on the host computer and the printer
5. Enter a "Print" command on the keyboard of the host computer

   (NOTE: Refer to the User's manual as required to code the proper command.)
6. Check to see if printing is okay
   a. If printing is okay, prepare for switch testing
   b. If printing is not okay, complete the interface troubleshooting routine outlined in Figure 5

   ☐ Have your instructor check your work

D. Procedure for switch testing

1. Make sure the printer is turned ON
2. Press LF, FF, TOF, and STATUS switches alternately several times
   a. If the printer operates properly, move on to the next checkpoint
   b. If the printer doesn't operate at all, or operates improperly, complete the control panel troubleshooting routine outlined in Figure 5
3. Press the ON-LINE switch once
   a. If the ON-LINE lamp goes out, move on to the next checkpoint
   b. If the ON-LINE lamp stays on, complete control panel troubleshooting as previously outlined
4. Press the LF switch several times
   a. If paper feeds properly, move on to the next checkpoint
   b. If paper does not feed properly, complete the paper feed control troubleshooting routine outlined in Figure 6

JOB SHEET #31

5. Press the FF switch once
    a. If the printer properly feeds a one page portion of paper, move on to the next checkpoint
    b. If the paper feed is improper, complete paper feed control troubleshooting as previously outlined and/or control panel troubleshooting as previously outlined
6. Press the STATUS switch several times
    a. If the WP and PM lamps light alternately, move on to the next checkpoint
    b. If the lamps do not light properly, complete control panel troubleshooting as previously outlined
7. Set a page head at an optional position, then press the TOF switch once
    a. If the printer beeps, then move on to the next checkpoint
    b. If the printer does not beep, then complete control panel troubleshooting as previously outlined
8. Press the FF switch once
    a. If the page head comes to the same position on the next page, move on to the next checkpoint
    b. If the page head is irregular, complete paper feed control troubleshooting as previously outlined
9. Turn power OFF
10. Reassemble printer as required for a printer self test

    ☐ Have your instructor check your work

E. Procedure for conducting a printer self test

1. Press the LF switch and hold it down as you turn the printer power switch ON
2. Check to see if the carriage moves to the right and then back left to the home position
    a. If carriage movement is okay, move on to the next checkpoint
    b. If carriage movement is not okay, complete control panel troubleshooting as previously outlined

JOB SHEET #31

3. Check for proper spacing on the line feed
   a. If the proper portion of paper is fed at every line feed, move on to the next checkpoint
   b. If paper feed is not okay, complete paper feed control troubleshooting as previously outlined
4. Check for proper ribbon feed
   a. If ribbon feeds okay, move on to next checkpoint
   b. If ribbon feed is improper, complete ribbon control troubleshooting as previously outlined
5. Check for proper printing
   a. If printing is okay, move on to next checkpoint
   b. If printing is not okay, and no letter is printed or illegible letters are printed, then complete hammer control troubleshooting as outlined in Figure 8
   c. If printing is not okay, and spaces between letters have become smaller, then complete carriage control ② troubleshooting as outlined in Figure 11
   d. If printing is not okay, and spaces between letters have not become smaller, then complete wheel control ② troubleshooting as outlined in Figure 12
6. Check to see if carriage and ribbon feed motors are operating properly
   a. If the motors seem to be okay, move on to the next checkpoint
   b. If the carriage or ribbon feed motors seem to be holding up, complete motor hold troubleshooting as outlined in Figure 13
7. Turn the power OFF
8. Insert a clean sheet of paper in the printer
9. Turn the power ON and run a printer self test

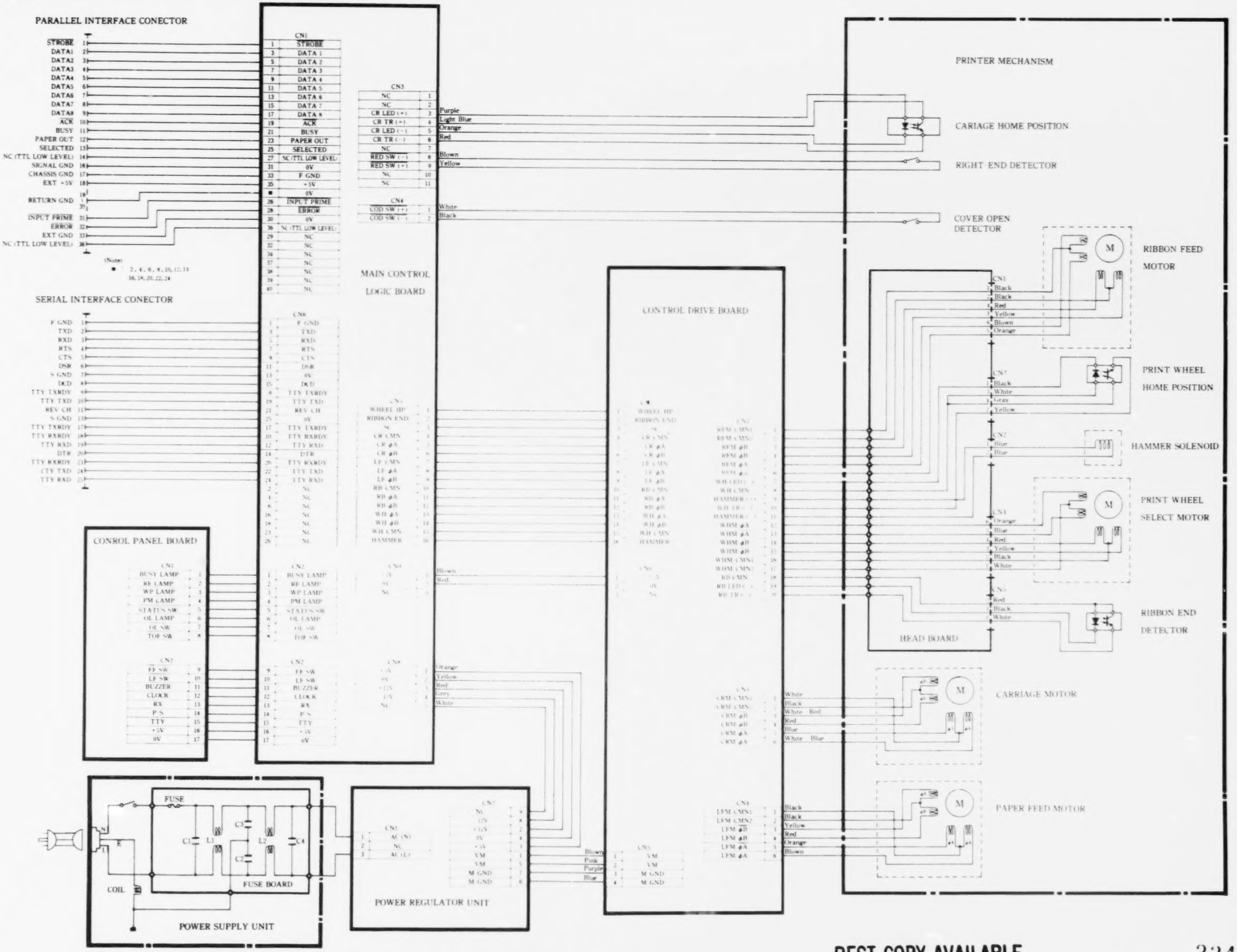
   ☐ Have your instructor check your work, including the printer self test
10. Clean up area and return tools and equipment to proper storage, or prepare for next job sheet as directed by your instructor

4. Wiring Scheme of PowerType

JOB SHEET #31

MPST - 387

FIGURE 2


PARALLEL INTERFACE CONECTOR
STROBE 1
DATA1 2
DATA2 3
DATA3 4
DATA4 5
DATA5 6
DATA6 7
DATA7 8
DATA8 9
ACK 10
BUSY 11
PAPER OUT 12
SELECTED 13
NC (TTL LOW LEVEL) 14
SIGNAL GND 16
CHASSIS GND 17
EXT +5V 18
RETURN GND 19 \ 30
INPUT PRIME 31
ERROR 32
EXT GND 33
NC (TTL LOW LEVEL) 36
(Note)
● : 2, 4, 6, 8, 10, 12, 14 16, 18, 20, 22, 24
SERIAL INTERFACE CONECTOR
F GND 1
TXD 2
RXD 3
RTS 4
CTS 5
DSR 6
S GND 7
DCD 8
TTY TXRDY 9
TTY TXD 10
REV CH 11
S GND 13
TTY TXRDY 17
TTY RXRDY 18
TTY RXD 19
DTR 20
TTY RXRDY 23
TTY TXD 24
TTY RXD 25
CN1
1 STROBE
3 DATA 1
5 DATA 2
7 DATA 3
9 DATA 4
11 DATA 5
13 DATA 6
15 DATA 7
17 DATA 8
19 ACK
21 BUSY
23 PAPER OUT
25 SELECTED
27 NC (TTL LOW LEVEL)
31 0V
33 F GND
35 +5V
● 0V
26 INPUT PRIME
28 ERROR
30 0V
36 NC (TTL LOW LEVEL)
29 NC
32 NC
34 NC
37 NC
38 NC
39 NC
40 NC
CN3
NC 1
NC 2
CR LED (+) 3 Purple
CR TR (+) 4 Light Blue
CR LED (−) 5 Orange
CR TR (−) 6 Red
NC 7
RED SW (−) 8 Blown
RED SW (+) 9 Yellow
NC 10
NC 11
CN4
COD SW (+) 1 White
COD SW (−) 2 Black
MAIN CONTROL LOGIC BOARD
CN6
1 F GND
3 TXD
5 RXD
7 RTS
9 CTS
11 DSR
13 0V
15 DCD
8 TTY TXRDY
19 TTY TXD
21 REV CH
25 0V
17 TTY TXRDY
10 TTY RXRDY
12 TTY RXD
14 DTR
20 TTY RXRDY
22 TTY TXD
24 TTY RXD
2 NC
4 NC
6 NC
16 NC
18 NC
23 NC
26 NC
CN5
WHEEL HP 1
RIBBON END 2
NC 3
CR CMN 4
CR φA 5
CR φB 6
LF CMN 7
LF φA 8
LF φB 9
RB CMN 10
RB φA 11
RB φB 12
WH φA 13
WH φB 14
WH CMN 15
HAMMER 16
CN2
1 BUSY LAMP
2 RF LAMP
3 WP LAMP
4 PM LAMP
5 STATUS SW
6 OL LAMP
7 OL SW
8 TOF SW
9 FF SW
10 LF SW
11 BUZZER
12 CLOCK
13 RX
14 P/S
15 TTY
16 +5V
17 0V
CN9
+5V 1 Blown
0V 2 Red
NC 3
CN8
+5V 1 Orange
0V 2 Yellow
+12V 3 Red
12V 4 Grey
NC 5 White
CONROL PANEL BOARD
CN1
BUSY LAMP 1
RF LAMP 2
WP LAMP 3
PM LAMP 4
STATUS SW 5
OL LAMP 6
OL SW 7
TOF SW 8
CN2
FF SW 9
LF SW 10
BUZZER 11
CLOCK 12
RX 13
P/S 14
TTY 15
+5V 16
0V 17
FUSE
C1
L1
C3
C2
L2
C4
N
E
L
COIL
FUSE BOARD
POWER SUPPLY UNIT
CN1
1 AC (N)
2 NC
3 AC (L)
CN2
NC 9
12V 8
+12V 2
0V 4
+5V 3
VM 1
VM 5
M GND 7
M GND 6
POWER REGULATOR UNIT
Blown
Pink
Purple
Blue
CN5
1 VM
2 VM
3 M GND
4 M GND
CONTROL DRIVE BOARD
CN4
1 WHEEL HP
2 RIBBON END
3 NC
4 CR CMN
5 CR φA
6 CR φB
7 LF CMN
8 LF φA
9 LF φB
10 RB CMN
11 RB φA
12 RB φB
13 WH φA
14 WH φB
15 WH CMN
16 HAMMER
CN6
1 +5V
2 0V
3 NC
CN2
RFM CMN1 1
RFM CMN2 2
RFM φB 3
RFM φB 4
RFM φA 5
RFM φA 6
WH LED (+) 7
WH CMN 8
HAMMER (+) 9
WH TR (+) 10
HAMMER (−) 11
WHM φA 12
WHM φA 13
WHM φB 14
WHM φB 15
WHM CMN1 16
WHM CMN2 17
RB CMN 18
RB LED (+) 19
RB TR (+) 20
CN3
CRM CMN1 1 White
CRM CMN2 2 Black
CRM φB 3 White Red
CRM φB 4 Red
CRM φA 5 Blue
CRM φA 6 White Blue
CN4
LFM CMN1 1 Black
LFM CMN2 2 Black
LFM φB 3 Yellow
LFM φB 4 Red
LFM φA 5 Orange
LFM φA 6 Blown
PRINTER MECHANISM
CARIAGE HOME POSITION
RIGHT END DETECTOR
COVER OPEN DETECTOR
RIBBON FEED MOTOR
PRINT WHEEL HOME POSITION
HAMMER SOLENOID
PRINT WHEEL SELECT MOTOR
RIBBON END DETECTOR
CN1 Black Black Red Yellow Blown Orange
CN7 Black White Gray Yellow
CN2 Blue Blue
CN3 Orange Blue Red Yellow Black White
CN6 Red Black White
HEAD BOARD
M
φA
φB
CARRIAGE MOTOR
PAPER FEED MOTOR

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JOB SHEET #31

FIGURE 3

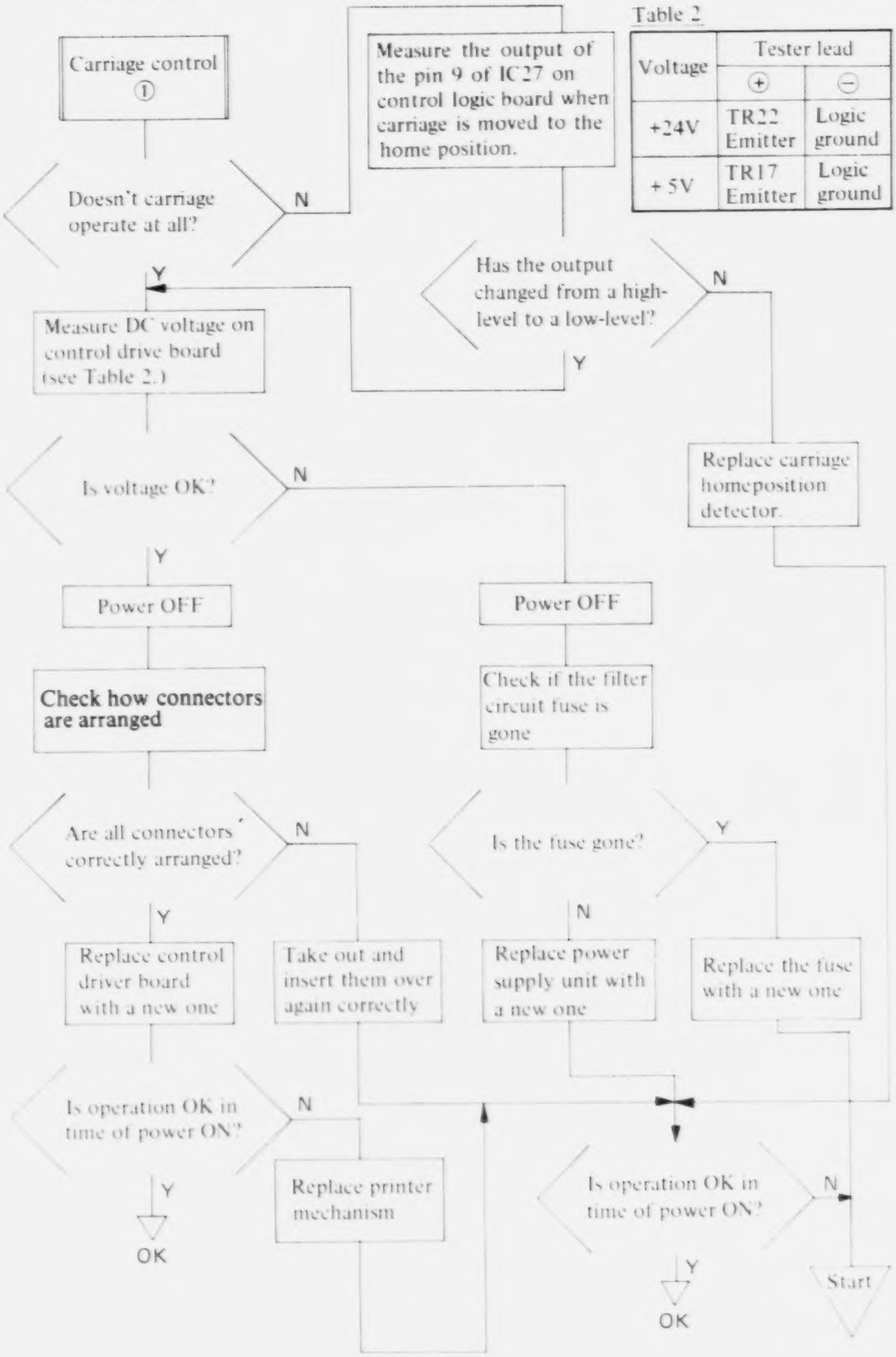
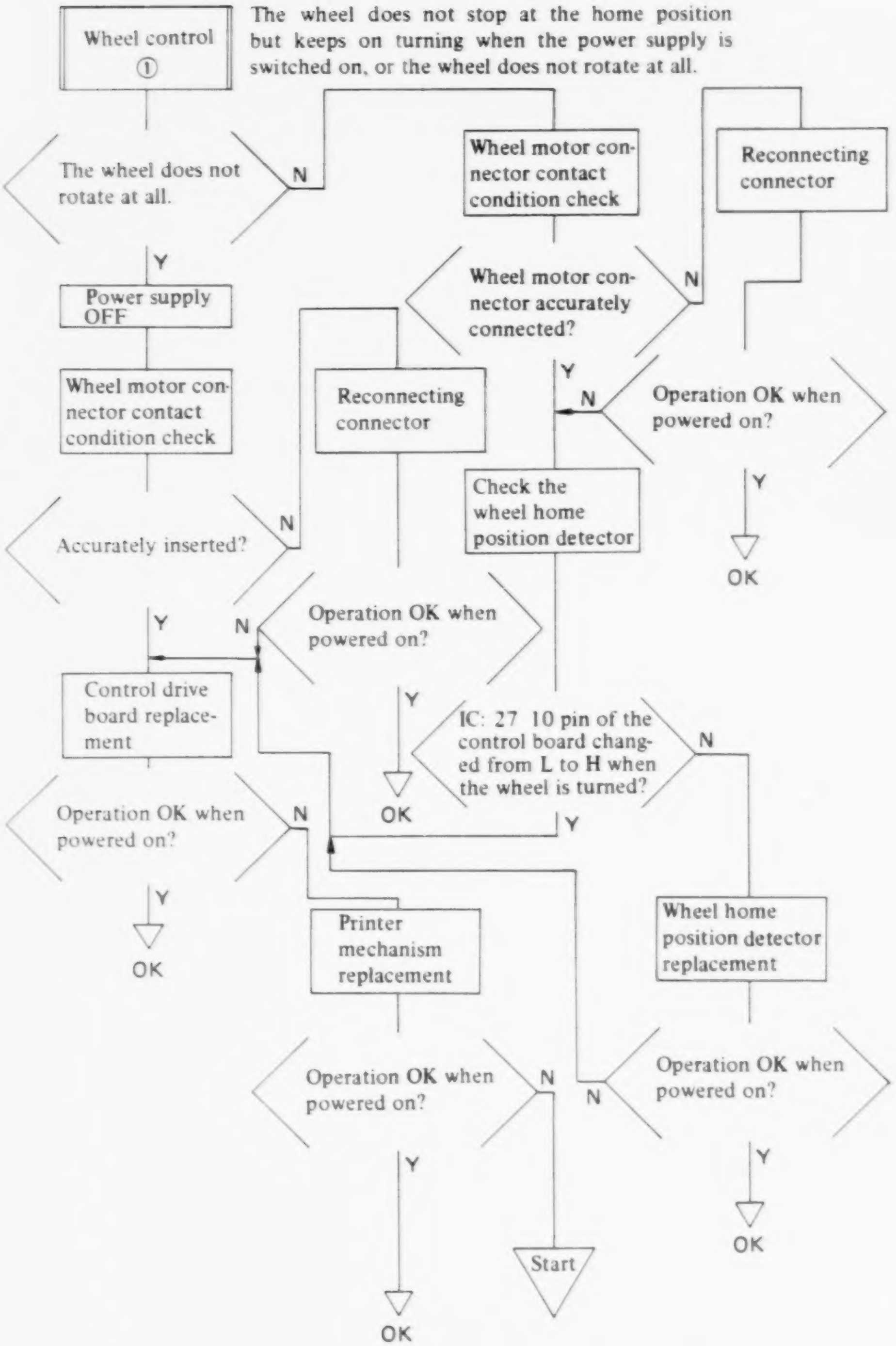

Carriage control ①
Doesn't carriage operate at all?
N
Y
Measure the output of the pin 9 of IC27 on control logic board when carriage is moved to the home position.
Has the output changed from a high-level to a low-level?
N
Y
Replace carriage homeposition detector.
Measure DC voltage on control drive board (see Table 2.)
Is voltage OK?
N
Y
Power OFF
Power OFF
Check how connectors are arranged
Check if the filter circuit fuse is gone
Are all connectors correctly arranged?
N
Y
Is the fuse gone?
Y
N
Replace control driver board with a new one
Take out and insert them over again correctly
Replace power supply unit with a new one
Replace the fuse with a new one
Is operation OK in time of power ON?
N
Y
OK
Replace printer mechanism
Is operation OK in time of power ON?
N
Y
OK
Start

Table 2

Voltage	Tester lead	
	⊕	⊖
+24V	TR22 Emitter	Logic ground
+ 5V	TR17 Emitter	Logic ground

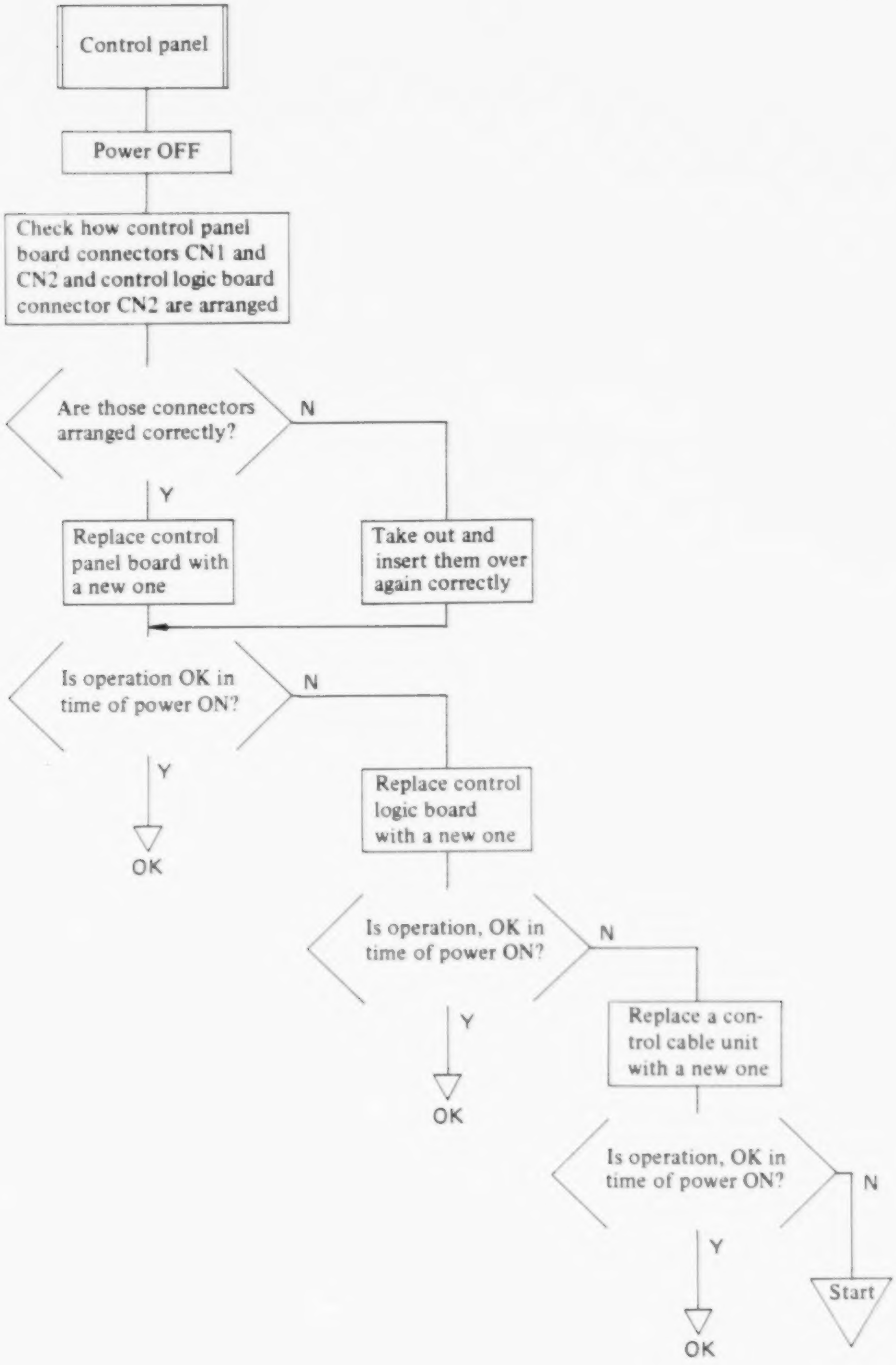
JOB SHEET #31

FIGURE 4


Wheel control ①
The wheel does not stop at the home position but keeps on turning when the power supply is switched on, or the wheel does not rotate at all.
The wheel does not rotate at all.
N
Y
Power supply OFF
Wheel motor connector contact condition check
Accurately inserted?
N
Y
Control drive board replacement
Operation OK when powered on?
N
Y
OK
Wheel motor connector contact condition check
Wheel motor connector accurately connected?
N
Y
Reconnecting connector
Operation OK when powered on?
N
Y
OK
Reconnecting connector
Operation OK when powered on?
N
Y
OK
Check the wheel home position detector
IC: 27 10 pin of the control board changed from L to H when the wheel is turned?
N
Y
Printer mechanism replacement
Operation OK when powered on?
N
Y
OK
Start
Wheel home position detector replacement
Operation OK when powered on?
N
Y
OK

JOB SHEET #31

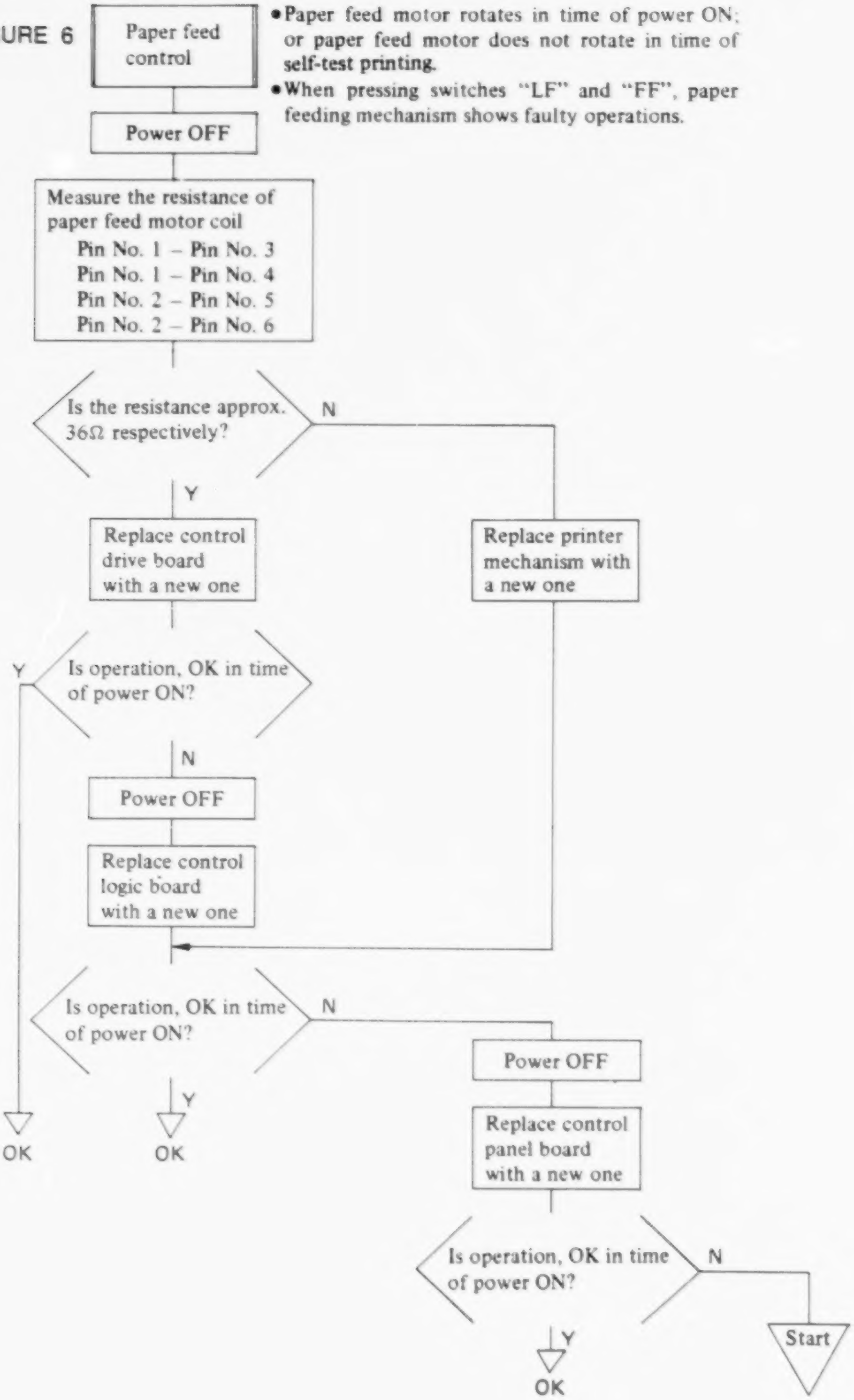
FIGURE 5


Control panel
Power OFF
Check how control panel board connectors CN1 and CN2 and control logic board connector CN2 are arranged
Are those connectors arranged correctly?
N
Y
Replace control panel board with a new one
Take out and insert them over again correctly
Is operation OK in time of power ON?
N
Y
OK
Replace control logic board with a new one
Is operation, OK in time of power ON?
N
Y
OK
Replace a control cable unit with a new one
Is operation, OK in time of power ON?
N
Y
OK
Start

JOB SHEET #31

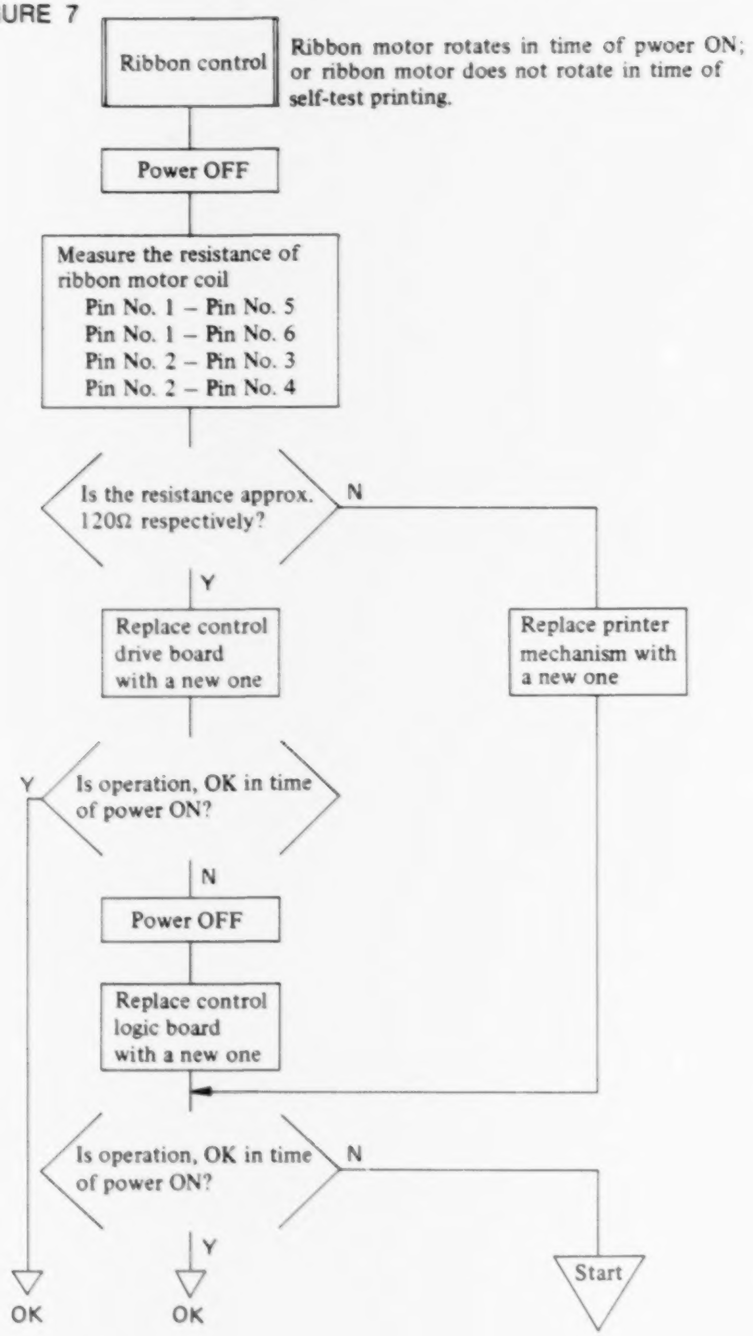
FIGURE 6

- Paper feed motor rotates in time of power ON; or paper feed motor does not rotate in time of **self-test printing.**
- When pressing switches "LF" and "FF", paper feeding mechanism shows faulty operations.


Paper feed control
Power OFF
Measure the resistance of paper feed motor coil
Pin No. 1 – Pin No. 3
Pin No. 1 – Pin No. 4
Pin No. 2 – Pin No. 5
Pin No. 2 – Pin No. 6
Is the resistance approx. 36Ω respectively?
N
Y
Replace control drive board with a new one
Replace printer mechanism with a new one
Y
Is operation, OK in time of power ON?
N
Power OFF
Replace control logic board with a new one
Is operation, OK in time of power ON?
N
Y
OK
OK
Power OFF
Replace control panel board with a new one
Is operation, OK in time of power ON?
N
Y
OK
Start

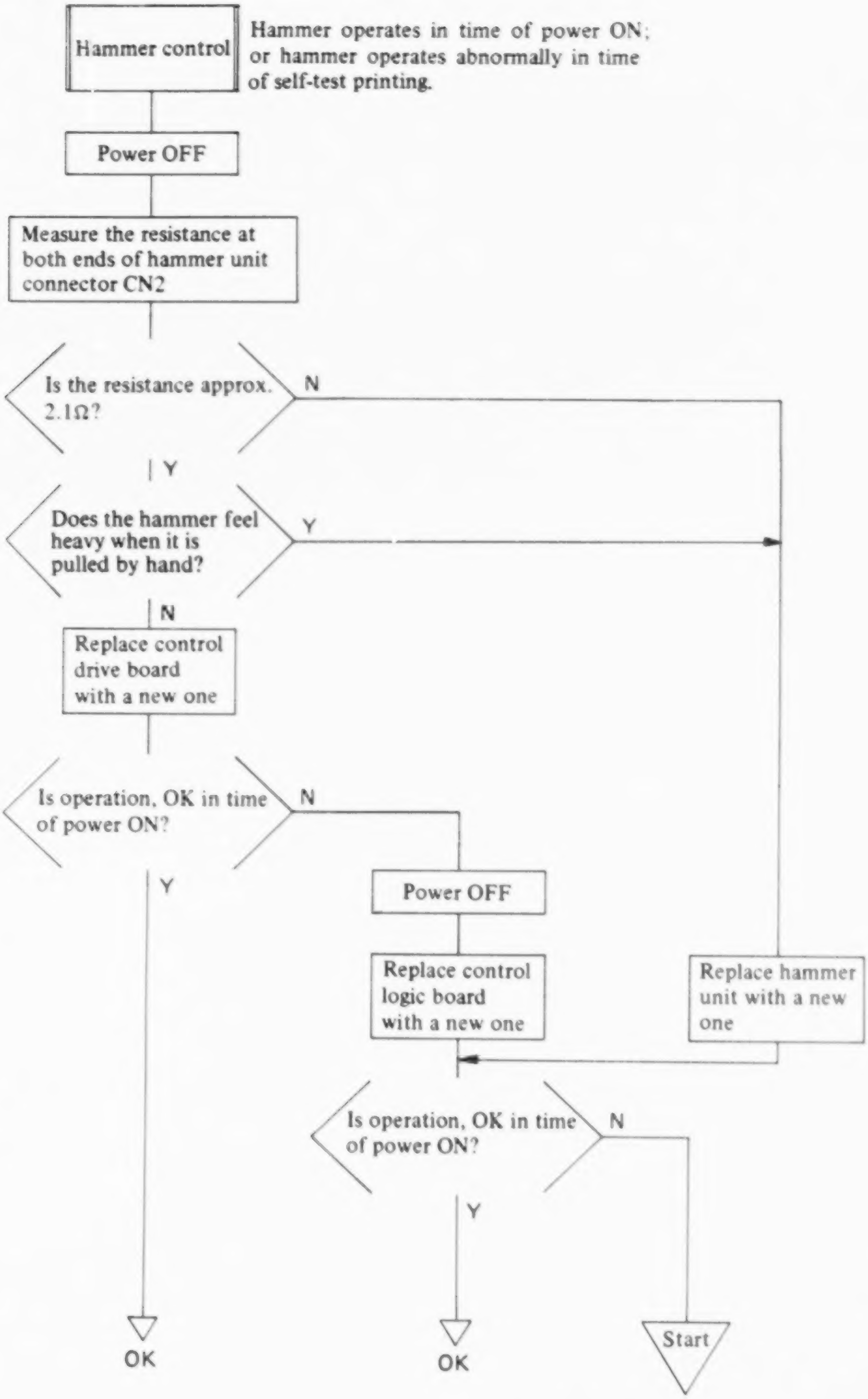
JOB SHEET #31

FIGURE 7


Ribbon control
Ribbon motor rotates in time of pwoer ON; or ribbon motor does not rotate in time of self-test printing.
Power OFF
Measure the resistance of ribbon motor coil
Pin No. 1 – Pin No. 5
Pin No. 1 – Pin No. 6
Pin No. 2 – Pin No. 3
Pin No. 2 – Pin No. 4
Is the resistance approx. 120Ω respectively?
N
Y
Replace control drive board with a new one
Replace printer mechanism with a new one
Y
Is operation, OK in time of power ON?
N
Power OFF
Replace control logic board with a new one
Is operation, OK in time of power ON?
N
Y
OK
OK
Start

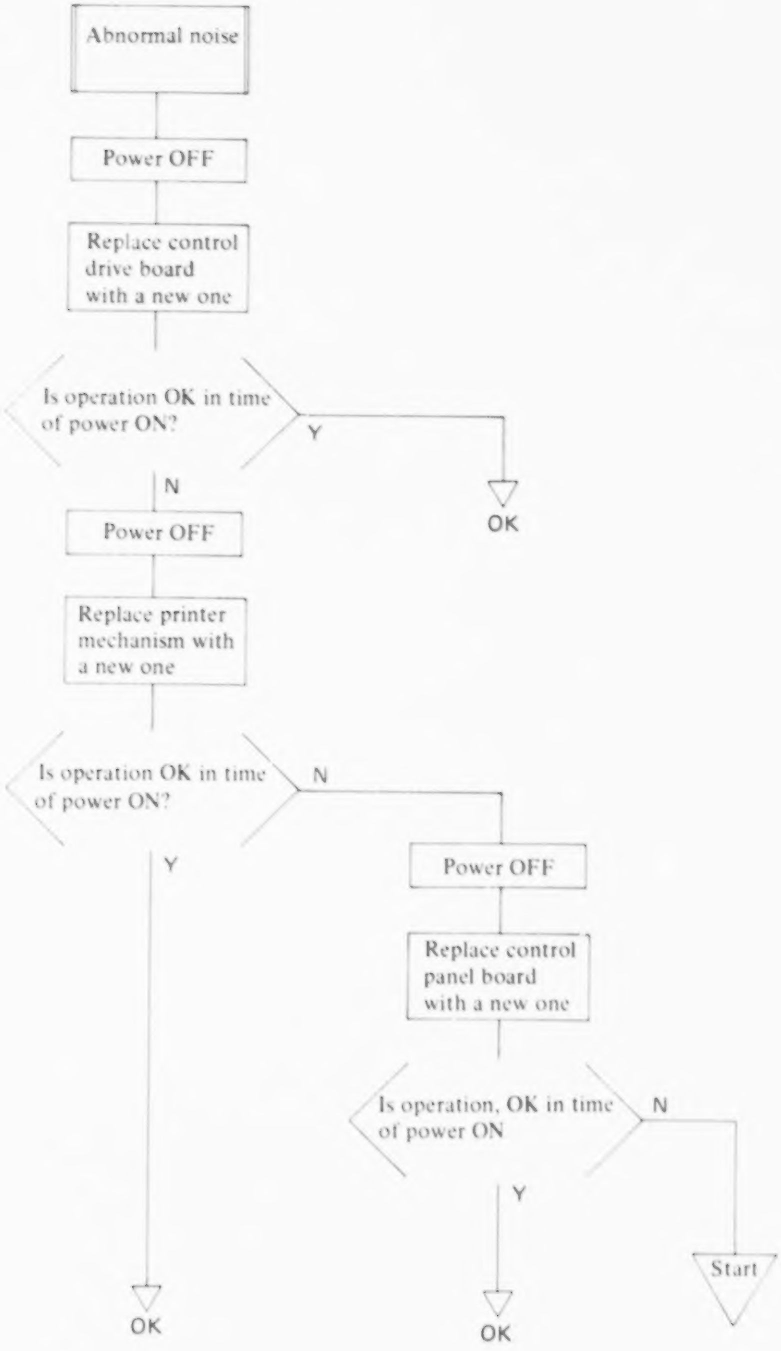
JOB SHEET #31

FIGURE 8


Hammer control
Hammer operates in time of power ON; or hammer operates abnormally in time of self-test printing.
Power OFF
Measure the resistance at both ends of hammer unit connector CN2
Is the resistance approx. 2.1Ω?
N
Y
Does the hammer feel heavy when it is pulled by hand?
Y
N
Replace control drive board with a new one
Is operation, OK in time of power ON?
N
Y
Power OFF
Replace control logic board with a new one
Replace hammer unit with a new one
Is operation, OK in time of power ON?
N
Y
OK
OK
Start

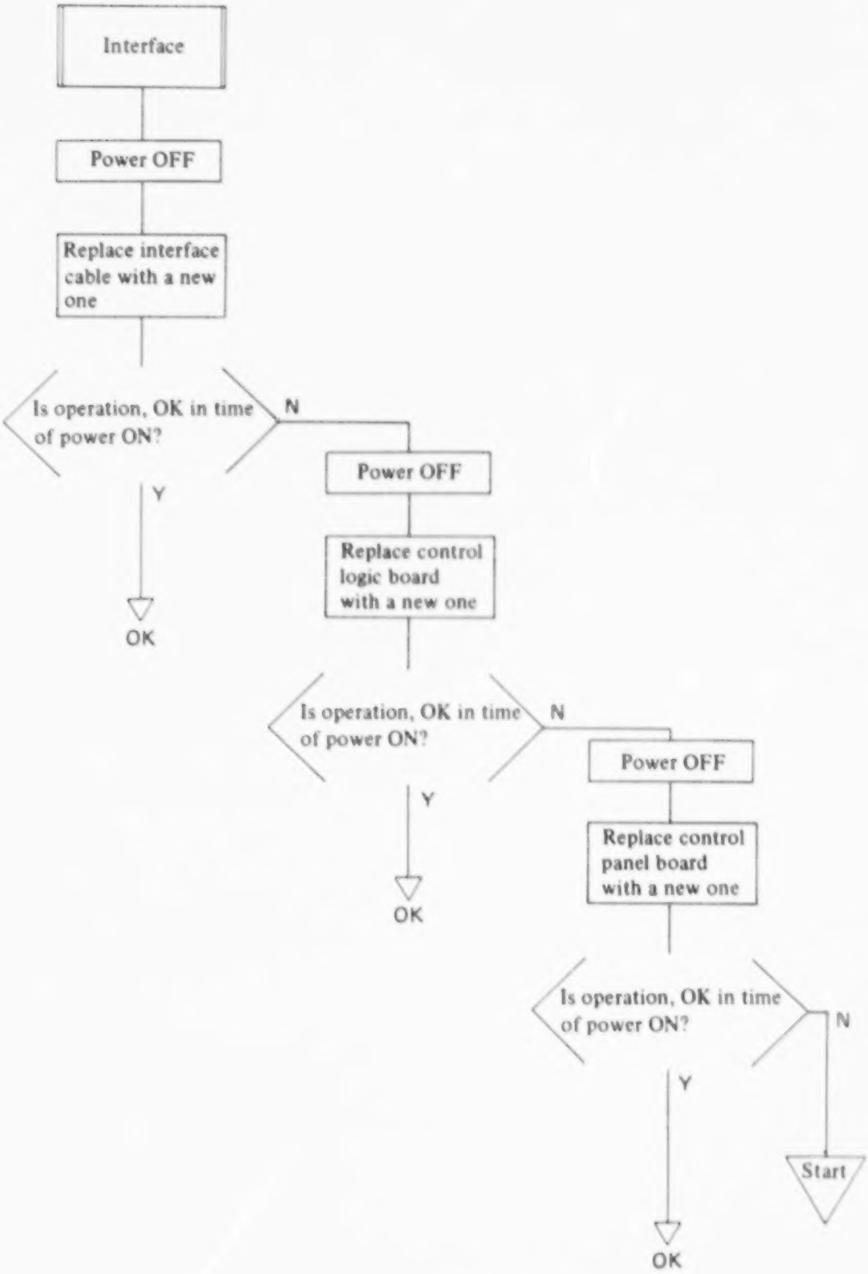
JOB SHEET #31

FIGURE 9


Abnormal noise
Power OFF
Replace control drive board with a new one
Is operation OK in time of power ON?
Y
OK
N
Power OFF
Replace printer mechanism with a new one
Is operation OK in time of power ON?
N
Y
OK
Power OFF
Replace control panel board with a new one
Is operation, OK in time of power ON
N
Y
OK
Start

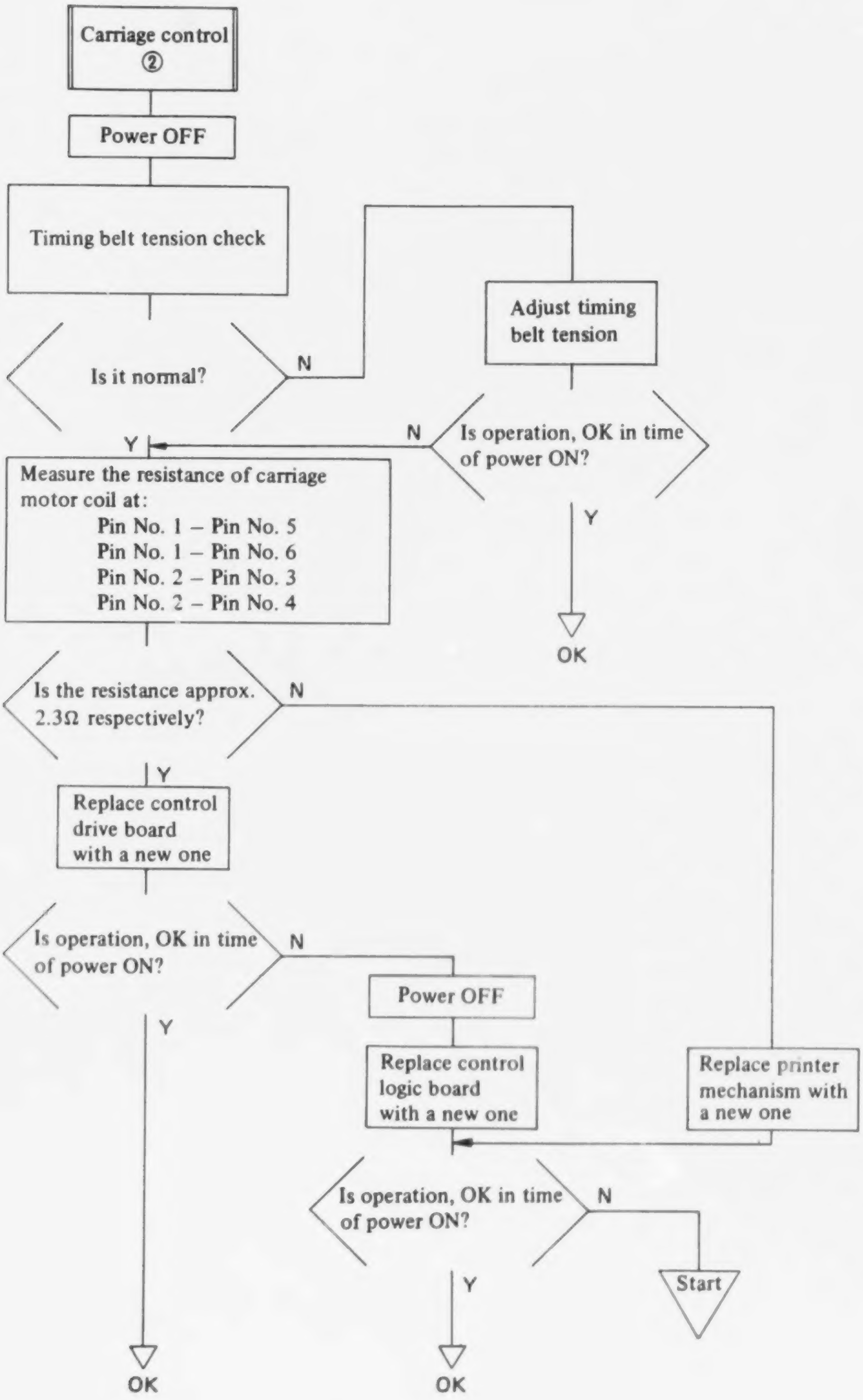
JOB SHEET #31

FIGURE 10


Interface
Power OFF
Replace interface cable with a new one
Is operation, OK in time of power ON?
N
Y
OK
Power OFF
Replace control logic board with a new one
Is operation, OK in time of power ON?
N
Y
OK
Power OFF
Replace control panel board with a new one
Is operation, OK in time of power ON?
N
Y
OK
Start

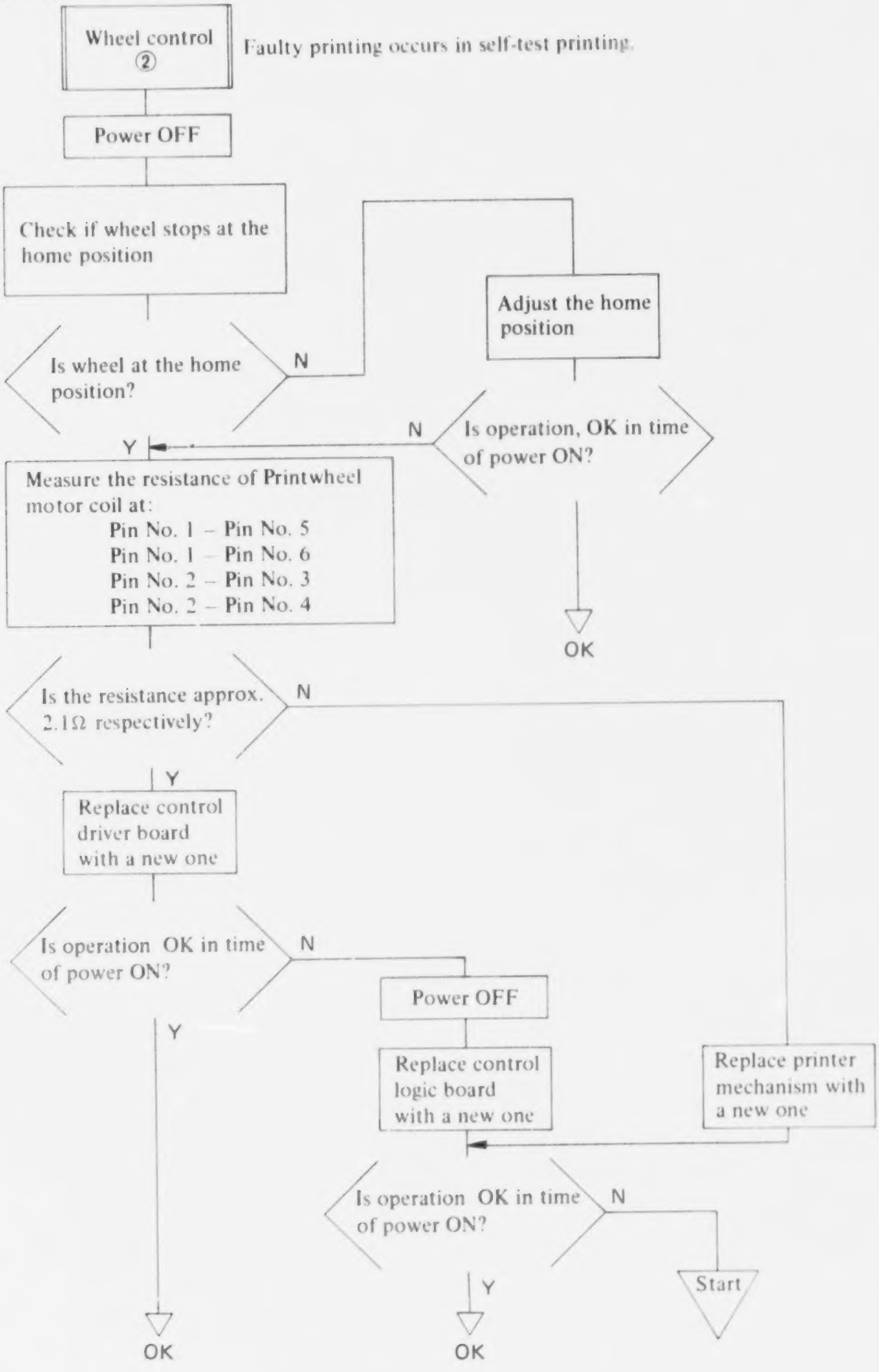
JOB SHEET #31

FIGURE 11


Carriage control ②
Power OFF
Timing belt tension check
Is it normal?
N
Adjust timing belt tension
Is operation, OK in time of power ON?
N
Y
OK
Y
Measure the resistance of carriage motor coil at:
Pin No. 1 – Pin No. 5
Pin No. 1 – Pin No. 6
Pin No. 2 – Pin No. 3
Pin No. 2 – Pin No. 4
Is the resistance approx. 2.3Ω respectively?
N
Y
Replace control drive board with a new one
Is operation, OK in time of power ON?
N
Y
OK
Power OFF
Replace control logic board with a new one
Replace printer mechanism with a new one
Is operation, OK in time of power ON?
N
Y
OK
Start

JOB SHEET #31

FIGURE 12


Wheel control ②
Power OFF
Check if wheel stops at the home position
Is wheel at the home position?
N
Adjust the home position
Is operation, OK in time of power ON?
N
Y
Measure the resistance of Printwheel motor coil at:
Pin No. 1 – Pin No. 5
Pin No. 1 – Pin No. 6
Pin No. 2 – Pin No. 3
Pin No. 2 – Pin No. 4
OK
Is the resistance approx. 2.1Ω respectively?
N
Y
Replace control driver board with a new one
Is operation OK in time of power ON?
N
Power OFF
Y
Replace control logic board with a new one
Replace printer mechanism with a new one
Is operation OK in time of power ON?
N
Y
Start
OK
OK

Faulty printing occurs in self-test printing.

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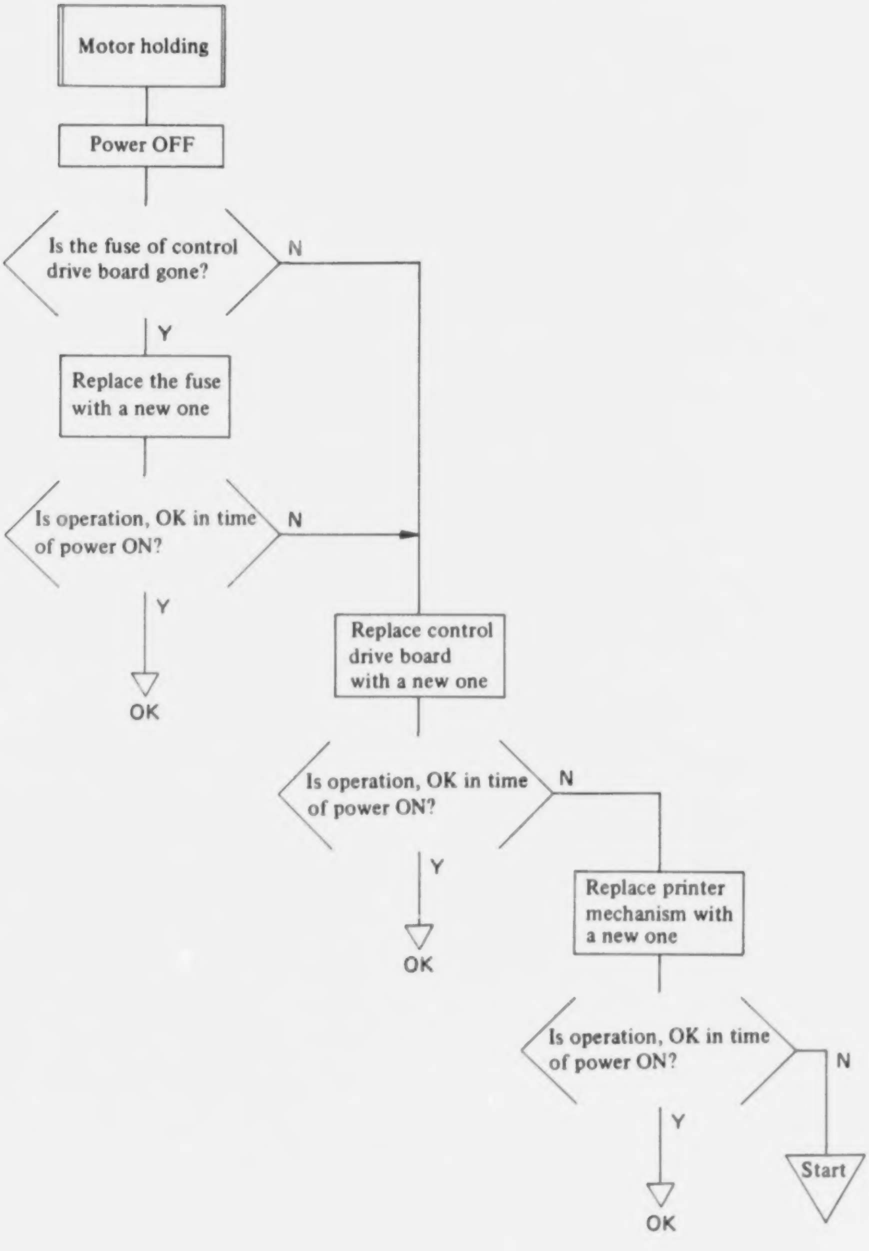
JOB SHEET #31

FIGURE 13


Motor holding
Power OFF
Is the fuse of control drive board gone?
N
Y
Replace the fuse with a new one
Is operation, OK in time of power ON?
N
Y
OK
Replace control drive board with a new one
Is operation, OK in time of power ON?
N
Y
OK
Replace printer mechanism with a new one
Is operation, OK in time of power ON?
N
Y
OK
Start

SERVICING AND REPAIRING LETTER-QUALITY PRINTERS
UNIT III

JOB SHEET #32 — TROUBLESHOOT A POWERTYPE PRINTER FOR FAULTY COMPONENTS

A. Tools and equipment

1. Printer as selected by instructor
2. *Daisywheel Printer PowerType Technical Manual*
3. Hand tools
4. DVOM
5. Dual-trace oscilloscope
6. Troubleshooting log (from previous job sheets)
7. Replacement parts as required

B. Procedure for adjustment (Figure 1)

(NOTE: The procedures and illustrations in this job sheet are adapted from materials copyrighted ©1984 by Star Micronics, Inc., and are reprinted with permission.)

1. Sign on your troubleshooting log and turn printer OFF
2. Check the ink ribbon cassette to make sure it is okay
3. Place test paper in the printer and move the carriage to the center of the printer
4. Check for carriage-related malfunctions
    a. If there are no carriage-related malfunctions, move on to the next checkpoint
    b. If there are carriage-related malfunctions, complete the carriage-related troubleshooting routine outlined in Figure 1

    (NOTE: Remember to refer to the schematics in Figures 1 and 2 of Job Sheet #31 as you complete the routines outlined in this job sheet.)
5. Check for wheel-related malfunctions
    a. If there are no wheel-related malfunctions, move on to the next checkpoint
    b. If there are wheel-related malfunctions, complete the wheel-related troubleshooting routine outlined in Figure 2

JOB SHEET #32

6. Check for hammer-related malfunctions
    a. If there are no hammer-related malfunctions, move on to the next checkpoint
    b. If there are hammer-related malfunctions, complete the hammer-related troubleshooting outlined in Figure 3
7. Check for paper feed-related malfunctions
    a. If there are no paper feed-related malfunctions, move on to the next checkpoint
    b. If there are hammer-related malfunctions, complete the hammer-related troubleshooting outlined in Figure 3
8. Check for ribbon-related malfunctions
    a. If there are no ribbon-related malfunctions, move on to the next checkpoint
    b. If there are ribbon-related malfunctions, complete the ribbon-related troubleshooting outlined in Figure 5
9. Check for interface-related malfunctions
    a. If there are no interface-related malfunctions, move on to the next checkpoint
    b. If there are interface-related malfunctions, complete the interface-related troubleshooting outlined in Figure 6

☐ Have your instructor check your work

C. Procedure for troubleshooting other component malfunctions

1. Check to see that letters are properly printed
    a. If letters are properly printed, move on to next checkpoint
    b. If letters are not properly printed, check the BAUD rate
2. Check to see if jumper wires are properly connected
    a. If wires are properly connected move on to the next checkpoint
    b. If wires are not properly connected, reconnect them
3. Check to see if the outputs at pins #23 and #17 of control logic board IC 5 are at a low level
    a. If both pins are at a low level, move on to the next checkpoint
    b. If one or both pins are not at a low level, replace IC 5 with a new one

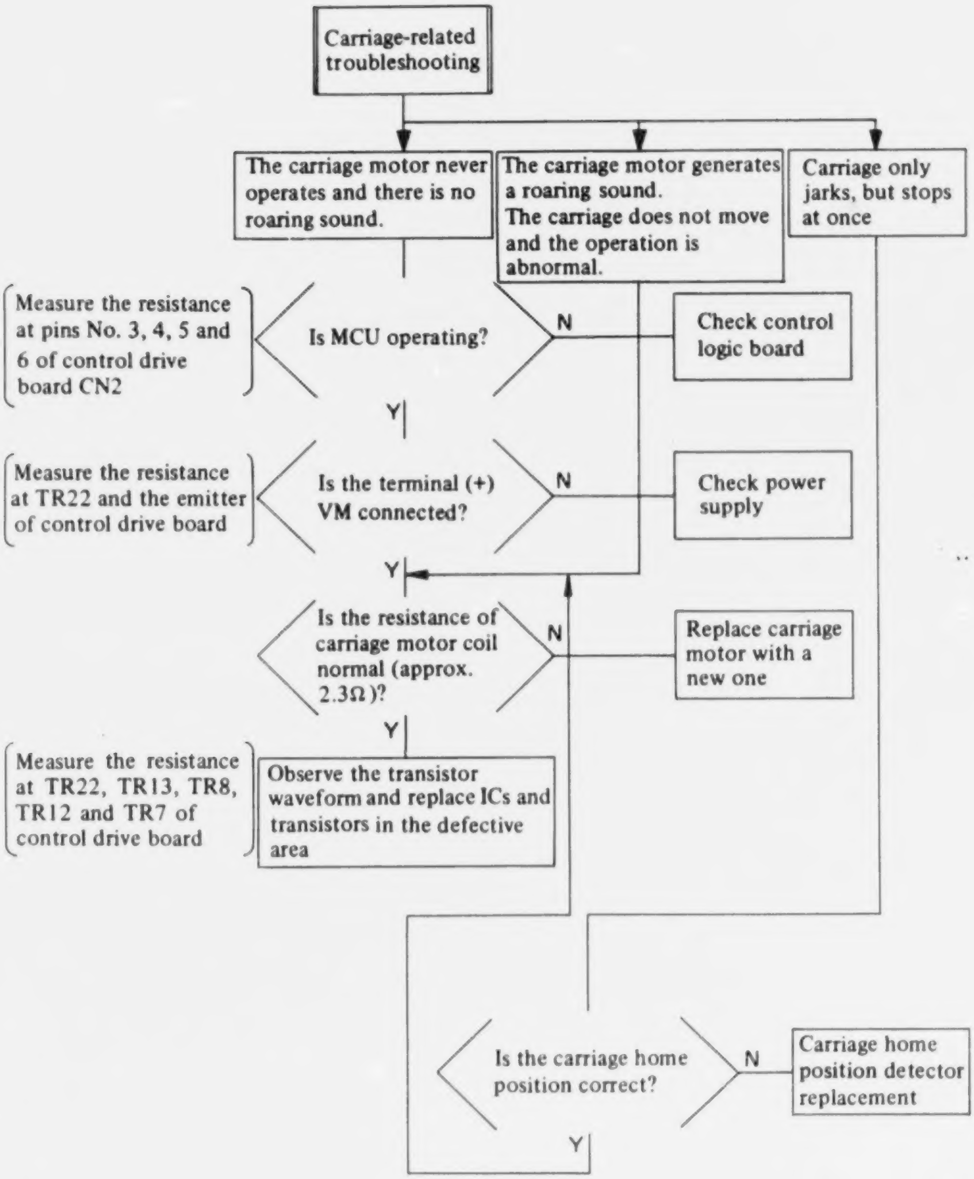
JOB SHEET #32

4. Check to see if the malfunction is with a serial transmission
    a. If it is not, move on to the next checkpoint
    b. If it is, check to see if the output at pin #3 of the control logic board has gone from a high to a low level
        1) If it has, check the host computer
        2) If it hasn't, check the TXD line
5. Check to see if the output of pin #21 of control logic board CN6 has gone from a high to a low level
    a. If it has, check the host computer for problems
    b. If it hasn't, check the REV-CH line
6. Reassemble the printer as required
7. Insert paper and run a printer self test

    ☐ Have your instructor check your work
8. Clean up area and return tools and equipment to proper storage

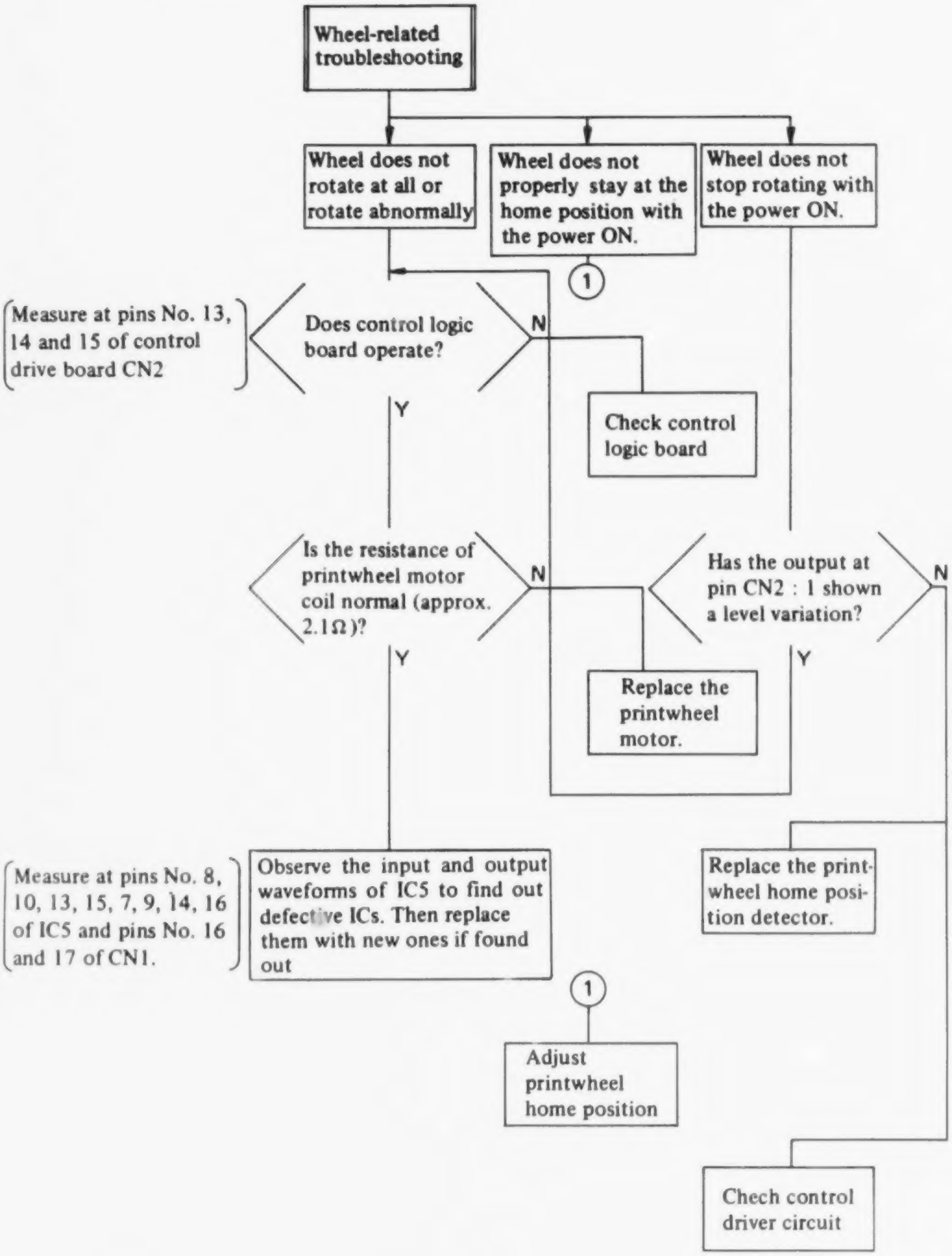
JOB SHEET #32

FIGURE 1


Carriage-related troubleshooting
The carriage motor never operates and there is no roaring sound.
The carriage motor generates a roaring sound. The carriage does not move and the operation is abnormal.
Carriage only jarks, but stops at once
Measure the resistance at pins No. 3, 4, 5 and 6 of control drive board CN2
Is MCU operating?
N
Check control logic board
Y
Measure the resistance at TR22 and the emitter of control drive board
Is the terminal (+) VM connected?
N
Check power supply
Y
Is the resistance of carriage motor coil normal (approx. 2.3Ω)?
N
Replace carriage motor with a new one
Y
Measure the resistance at TR22, TR13, TR8, TR12 and TR7 of control drive board
Observe the transistor waveform and replace ICs and transistors in the defective area
Is the carriage home position correct?
N
Carriage home position detector replacement
Y

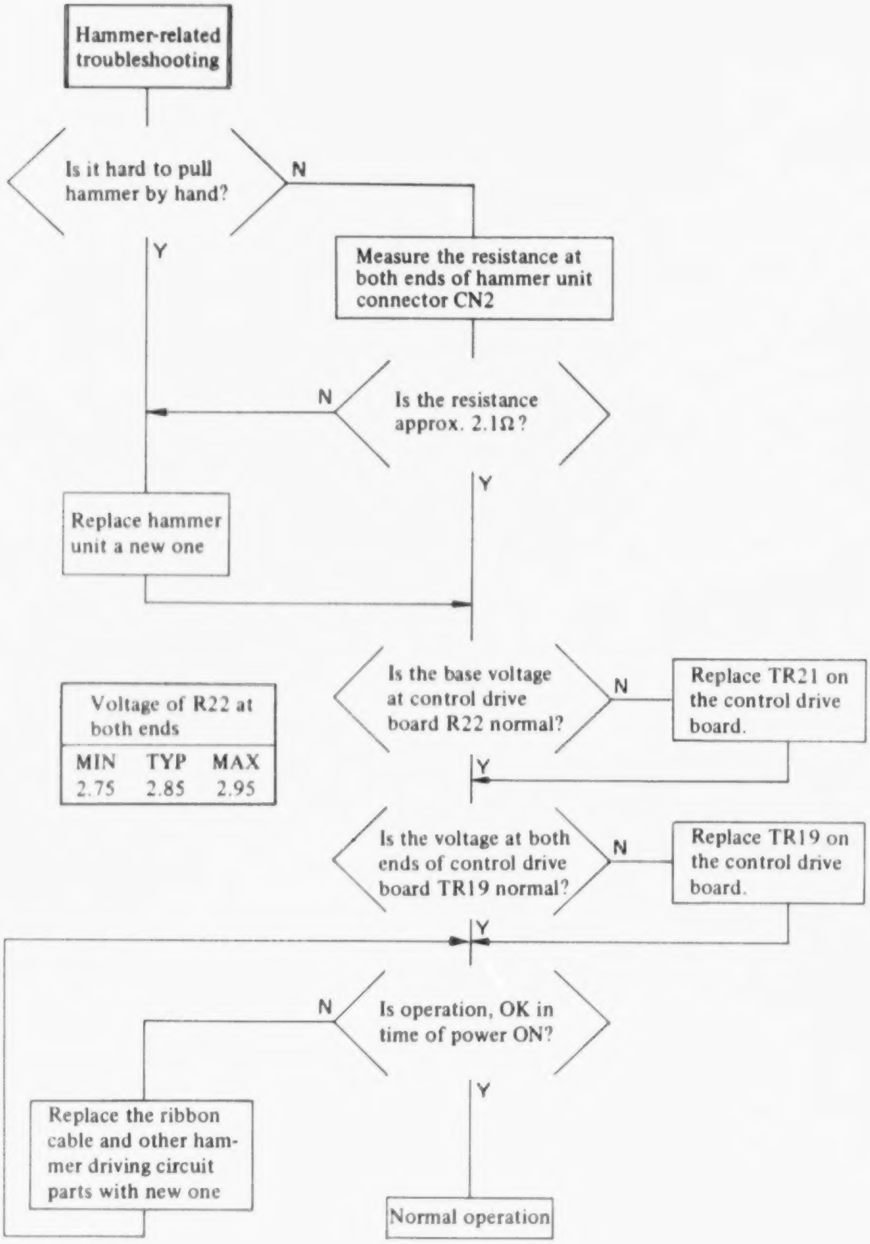
JOB SHEET #32

FIGURE 2


Wheel-related troubleshooting
Wheel does not rotate at all or rotate abnormally
Wheel does not properly stay at the home position with the power ON.
Wheel does not stop rotating with the power ON.
①
Measure at pins No. 13, 14 and 15 of control drive board CN2
Does control logic board operate?
N
Y
Check control logic board
Is the resistance of printwheel motor coil normal (approx. 2.1Ω)?
N
Y
Replace the printwheel motor.
Has the output at pin CN2 : 1 shown a level variation?
N
Y
Measure at pins No. 8, 10, 13, 15, 7, 9, 14, 16 of IC5 and pins No. 16 and 17 of CN1.
Observe the input and output waveforms of IC5 to find out defective ICs. Then replace them with new ones if found out
Replace the printwheel home position detector.
①
Adjust printwheel home position
Chech control driver circuit

JOB SHEET #32

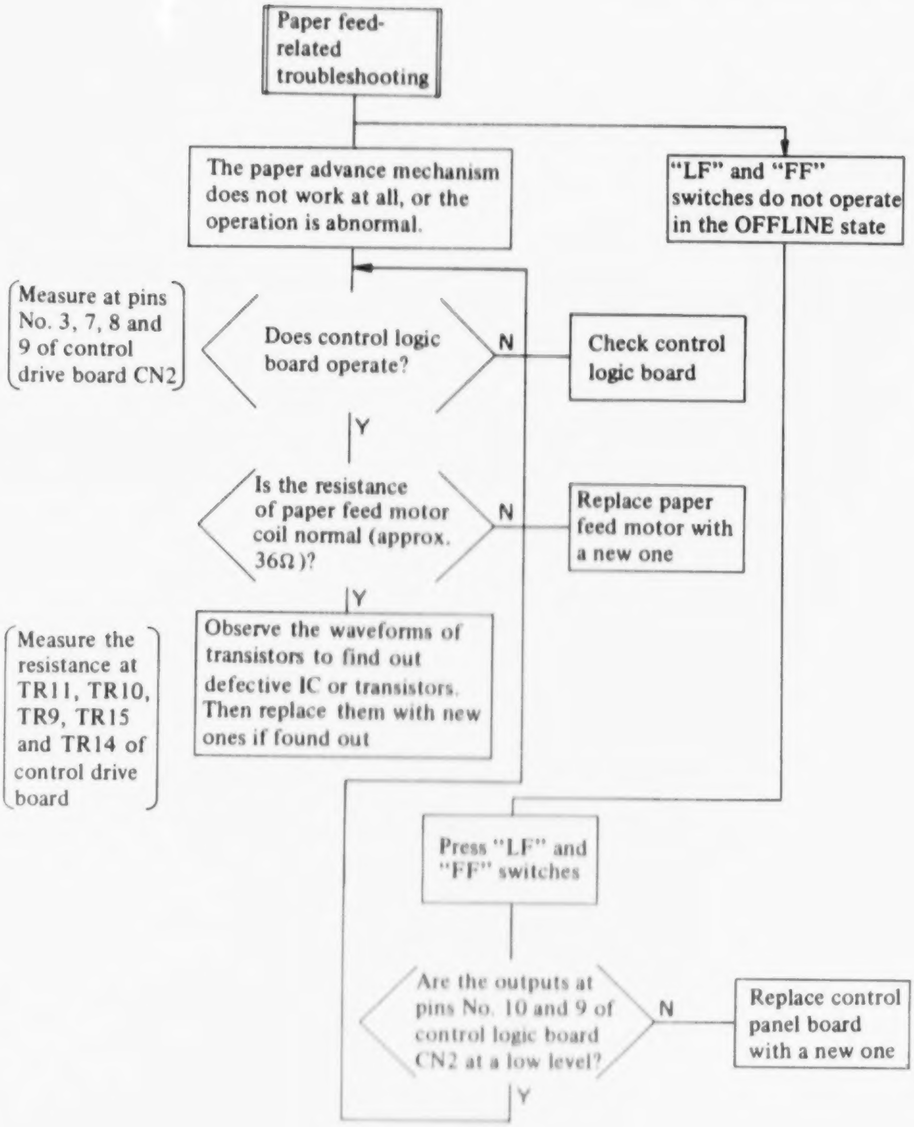
FIGURE 3


Hammer-related troubleshooting
Is it hard to pull hammer by hand?
N
Y
Measure the resistance at both ends of hammer unit connector CN2
N
Is the resistance approx. 2.1Ω?
Y
Replace hammer unit a new one
Is the base voltage at control drive board R22 normal?
N
Replace TR21 on the control drive board.
Y
Is the voltage at both ends of control drive board TR19 normal?
N
Replace TR19 on the control drive board.
Y
N
Is operation, OK in time of power ON?
Y
Replace the ribbon cable and other hammer driving circuit parts with new one
Normal operation

Voltage of R22 at both ends		
MIN	TYP	MAX
2.75	2.85	2.95

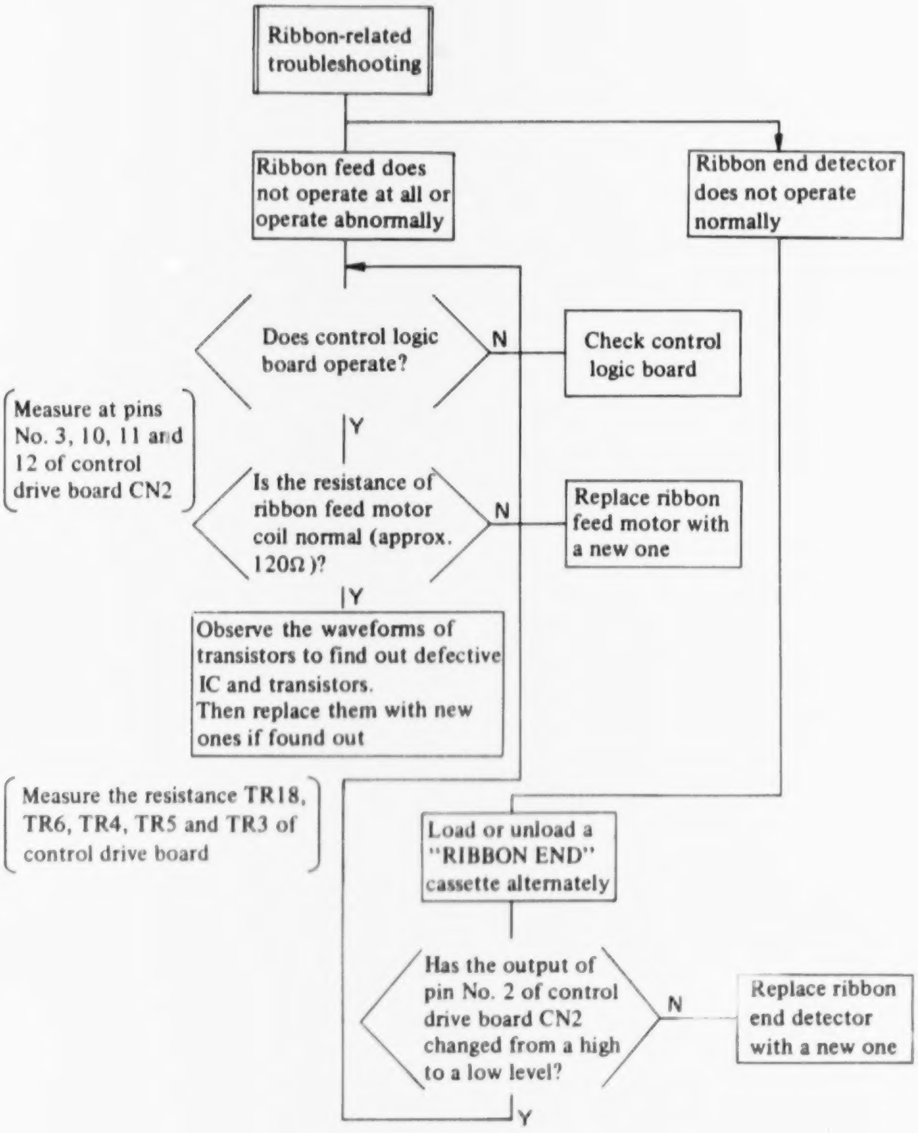
JOB SHEET #32

FIGURE 4


Paper feed-related troubleshooting
The paper advance mechanism does not work at all, or the operation is abnormal.
"LF" and "FF" switches do not operate in the OFFLINE state
Measure at pins No. 3, 7, 8 and 9 of control drive board CN2
Does control logic board operate?
N
Check control logic board
Y
Is the resistance of paper feed motor coil normal (approx. 36Ω)?
N
Replace paper feed motor with a new one
Y
Measure the resistance at TR11, TR10, TR9, TR15 and TR14 of control drive board
Observe the waveforms of transistors to find out defective IC or transistors. Then replace them with new ones if found out
Press "LF" and "FF" switches
Are the outputs at pins No. 10 and 9 of control logic board CN2 at a low level?
N
Replace control panel board with a new one
Y

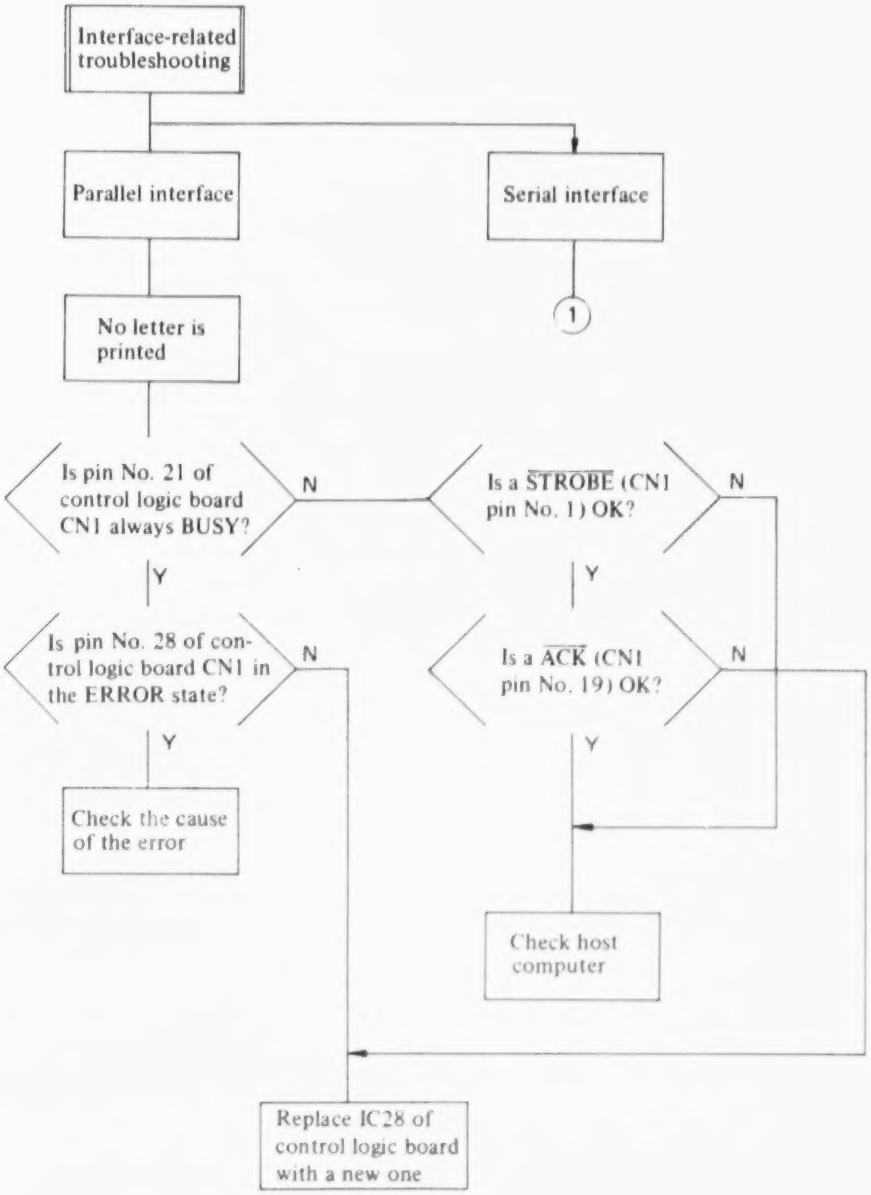
JOB SHEET #32

FIGURE 5


Ribbon-related troubleshooting
Ribbon feed does not operate at all or operate abnormally
Ribbon end detector does not operate normally
Does control logic board operate?
N
Check control logic board
Y
Measure at pins No. 3, 10, 11 and 12 of control drive board CN2
Is the resistance of ribbon feed motor coil normal (approx. 120Ω)?
N
Replace ribbon feed motor with a new one
Y
Observe the waveforms of transistors to find out defective IC and transistors. Then replace them with new ones if found out
Measure the resistance TR18, TR6, TR4, TR5 and TR3 of control drive board
Load or unload a "RIBBON END" cassette alternately
Has the output of pin No. 2 of control drive board CN2 changed from a high to a low level?
N
Replace ribbon end detector with a new one
Y

JOB SHEET #32

FIGURE 6


Interface-related troubleshooting
Parallel interface
Serial interface
1
No letter is printed
Is pin No. 21 of control logic board CN1 always BUSY?
N
Y
Is a $\overline{\text{STROBE}}$ (CN1 pin No. 1) OK?
N
Y
Is pin No. 28 of control logic board CN1 in the ERROR state?
N
Y
Is a $\overline{\text{ACK}}$ (CN1 pin No. 19) OK?
N
Y
Check the cause of the error
Check host computer
Replace IC28 of control logic board with a new one

SERVICING AND REPAIRING LETTER-QUALITY PRINTERS
UNIT III

NAME ________________________

TEST

1. Match the terms on the right with their correct definitions.

_____a. A schematic or block diagram notation for a connector

_____b. The measurement of the density of characters in a horizontal line of print

_____c. Another method of measuring the density of characters in a horizontal line of print

_____d. Printing at a pitch of 10 CPI which gives clear, easy-to-read letters and is a popular pitch for business letters and reports

_____e. Printing at a pitch of 12 CPI which puts more words on a page and is popular for business uses and for conserving space in long reports

_____f. Printing at a pitch of 15 CPI which is a popular pitch for tables and charts where much information has to go into limited space

_____g. A pitch that balances out white space between wide letters such as "M" and narrow letters such as "I" to make a printed page look better

_____h. A measurement of how fast a printer prints

_____i. The measurement of the number of lines in a vertical inch of space

_____j. Printing at 8 LPI

_____k. Printing at 6 LPI

_____l. Printing at 4 LPI

_____m. Printing at 2 LPI

1. Pica type
2. Double space
3. LPI
4. CN
5. Elite type
6. Single space
7. CPI
8. Condensed type
9. Space and a half
10. Pitch
11. Triple space
12. Proportional pitch
13. CPS

TEST

2. List four major components of a PowerType letter-quality printer.

a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

3. Match the PowerType control buttons and display lamps on the right with their functions.

_____a. Feeds paper continuously when pressed while printer is off line status, and activates the printer self test if pressed just as power is turned on

_____b. Feeds paper when pressed while printer is off line

_____c. Sets the page start position and causes a buzzer to ring when it is pressed

_____d. Controls the on line/off line status of the printer and is ON LINE when power is turned ON

_____e. Controls the WP or PM modes for controlling printer formats

_____f. Lights a green LED when printer is in an ON LINE status

_____g. Lights a green LED when printer is in the PM mode

_____h. Lights a green LED when the printer is in the WP mode

_____i. Lights a red LED when the ink ribbon has run out

_____j. Lights a green LED when the printer cannot receive information

_____k. Lights a green LED to indicate printer power is ON

1. BUSY lamp
2. FF button
3. LF button
4. ON LINE button
5. ON LINE lamp
6. PM lamp
7. POWER lamp
8. RE lamp
9. STATUS button
10. TOF button
11. WP lamp

TEST

4. Match the PowerType slide switches on the right with their functions.

_____a. Selects 11- or 12-inch paper length

_____b. Specifies line feed according to a CR (carriage return) code sent from the host computer, and inputs only with no line feed on a CR code, and automatically feeds one line on a CR/LF code

_____c. Used to show the spacing in columns per inch, and may be set to 10, 12, 15, or PS for proportional

_____d. Used to specify spaces between lines, and may be set at 3, 4, 6, or 8

_____e. Used to control printing pressure of the printwheel so when duplicate paper is used the pressure can be increased to heavy to compensate for the added paper thickness

1. COPY switch
2. LINE switch
3. PAPER switch
4. PITCH switch
5. SLEW switch

5. Complete the following statements concerning setting DIP switches on a PowerType printer by circling the word(s) that best completes each statement.

   a. DIP switch 1 controls the PowerType (**parallel, serial**) interface, and most printers are shipped with DIP switch 1 set for operation

   b. DIP switch 2 controls the PowerType (**parallel, serial**) interface

   c. Each of the DIP switches contains (**five, ten**) individual switches

   d. A pin is set to ON by pushing it towards the (**front, rear**) of the printer

   e. A (**ball-point pen, knife**) is a handy tool for setting the switch pins, but be sure to record the original pin settings before changing a pin

   f. Make sure that both the host computer and the printer are (**on, off**) before setting pins on a DIP switch

6. Solve the following problem concerning the PowerType parallel interface connector.

   A technician using a 25-pin connector to hook up a parallel printer is having problems getting the connector to fit the host computer. What is the solution?

   Answer ____

   ____

TEST

7. Solve the following problem concerning the PowerType serial interface connector.

   A technician using a 36-pin connector to hook up a serial printer is having problems getting the connector to fit the host computer. What is the solution?

   Answer ____

   ____

8. Complete statements concerning PowerType logic, drive, and power supply connectors by filling in the blanks with the correct words or letter/number combinations (such as CN5).

   (NOTE: Refer to Transparencies 8, 9, 10, and 11.)

   a. CN3 and ____________ are used for transmission and reception of signals between the printer mechanism and the control logic board

   b. ____________, CN3, and CN4 are used for transmission and reception of drive signals between the printer mechanism and the control drive board

   c. The ____________ connectors control the ribbon feed motor, the hammer solenoid, the printwheel home position, the printwheel selection motor, and the ribbon end detector through the terminal PC board

   d. CN5 on the control logic board and ____________ on the control drive board are used for the tranmission and reception of signals between the control logic board and the control drive board

   e. ____________ on the control board and CN6 on the control drive board provide the +5V power supply

   f. CN2 on the power regulator unit, ____________ the control logic board, and CN5 on the control drive board provide the power supply from the power regulator unit to the control board and the control drive board

   g. CN1 on the power regulator unit provides the power supply from the ____________ to the power regulator unit

9. Completes statements concerning printing modes on a PowerType by circling the word(s) or letter(s) that best completes each statement.

   a. For the printer to respond properly to control codes, a (**printing, status**) slide switch has to be set to select a printing mode

   b. When using a word processing package, the printer must be set in a (**PW, WP**) mode

   c. When using BASIC or another computer language, the printer must be set in a (**PM, PW**) mode

TEST

10. Match the PowerType detection mechanisms with their functions.

_____a. Causes the ON LINE lamp to go out when the printer cover is open and the printer will not print until the cover is firmly closed and the ON LINE button pressed

_____b. Senses the aluminum foil strip at the end of a ribbon, causes the printer to beep and stop printing as the ON LINE lamp goes out and the RE lamp comes on

_____c. Stops the printer before the print carriage overruns the maximum right end position so the printwheel will not be damaged

1. Right end detectors
2. Printer cover open detector
3. Ink ribbon end detector

11. Complete the following statements concerning PowerType alarms and their meanings by circling the correct figure(s) that best completes each statement.

a. **(Three, four)** short beep sounds in succession repeated three times indicates the end of the ribbon and time to install a new ribbon cartridge

b. A beep about **(¼, 1)** second long is a BEL code that may indicate the end of a printout or a printwheel problem

c. A **(three, four)** second beep indicates a problem with the right end detector but can also indicate general problems in CPU control functions

12. Arrange in order the following steps in cleaning a PowerType printer by placing the correct sequence numbers (1-6) in the appropriate blanks.

_____a. Use a soft cloth or brush (or both) to thoroughly dust off the inner components, and be sure to clean dust and dirt from the ribbon guide and the carriage mechanism

_____b. If the outside of the printer requires cleaning, use a damp cloth with alcohol and be careful not to drip alcohol intothe printer mechanism

_____c. Turn the printer off and disconnect the power cord before cleaning inside the printer

_____d. Lift the cover off, lay it carefully aside, and disconnect the cover open detector cable

_____e. Reassemble the printer and run a printer self test

_____f. Remove the interface connector from the printer, remove the platen knobs, and separate the upper case from the lower case by removing the seven screws, four at the back and three near the control panel

TEST

(NOTE: If these activities have not been accomplished prior to the test, ask your instructor when they should be completed.)

13. Demonstrate the ability to:

    a. Unpack, set up, and run a printer self test on a PowerType printer. (Job Sheet #1)

    b. Remove and replace the upper case, cover open detector, and printer cover on a PowerType printer. (Job Sheet #2)

    c. Remove and replace the control panel board on a PowerType printer. (Job Sheet #3)

    d. Remove and replace the control drive board on a PowerType printer. (Job Sheet #4)

    e. Remove and replace the control logic board on a PowerType printer. (Job Sheet #5)

    f. Remove and replace the power regulator unit and the power supply unit on a PowerType printer. (Job Sheet #6)

    g. Remove and replace the printer mechanism on a PowerType printer. (Job Sheet #7)

    h. Remove and replace the paper feed assembly on a PowerType printer. (Job Sheet #8)

    i. Remove and replace the carriage motor assembly on a PowerType printer. (Job Sheet #9)

    j. Remove and replace the ribbon feed motor assembly on a PowerType printer. (Job Sheet #10)

    k. Remove and replace the hammer unit on a PowerType printer. (Job Sheet #11)

    l. Remove and replace the carriage stay on a PowerType printer. (Job Sheet #12)

    m. Remove and replace the carriage assembly on a PowerType printer. (Job Sheet #13)

    n. Remove and replace the platen cover and platen assembly on a PowerType printer. (Job Sheet #14)

    o. Remove and replace the paper chute on a PowerType printer. (Job Sheet #15)

    p. Remove and replace the ball roller assembly on a PowerType printer. (Job Sheet #16)

TEST

q. Remove and replace the terminal board on a PowerType printer. (Job Sheet #17)

r. Remove and replace the printwheel home position detector on a PowerType printer. (Job Sheet #18)

s. Remove and replace the carriage home position detector on a PowerType printer. (Job Sheet #19)

t. Remove and replace the right end detector on a PowerType printer. (Job Sheet #20)

u. Remove and replace the ribbon end detector on a PowerType printer. (Job Sheet #21)

v. Remove and replace the primary and secondary fuses on a PowerType printer. (Job Sheet #22)

w. Make a mutual adjustment of the hammer and printwheel on a PowerType printer. (Job Sheet #23)

x. Make a position adjustment of the printwheel home position detector on a PowerType printer. (Job Sheet #24)

y. Adjust the platen position, idler gear backlash, and paper pressure/platen gap on a PowerType printer. (Job Sheet #25)

z. Adjust the timing belt tension on a PowerType printer. (Job Sheet #26)

aa. Adjust the carriage home position detector on a PowerType printer. (Job Sheet #27)

bb. Adjust the carriage right end detector on a PowerType printer. (Job Sheet #28)

cc. Adjust the ribbon cable on a PowerType printer. (Job Sheet #29)

dd. Adjust the power supply voltage on a PowerType printer. (Job Sheet #30)

SERVICING AND REPAIRING LETTER-QUALITY PRINTERS
UNIT III

ANSWERS TO TEST

1.
   a. 4
   b. 7
   c. 10
   d. 1
   e. 5
   f. 8
   g. 12
   h. 13
   i. 3
   j. 6
   k. 9
   l. 2
   m. 11

2. Any four of the following:
   a. Printer mechanism
   b. Control drive board
   c. Control logic board
   d. Control panel board
   e. Power regulator unit

3.
   a. 3
   b. 2
   c. 10
   d. 4
   e. 9
   f. 5
   g. 6
   h. 11
   i. 8
   j. 1
   k. 7

4.
   a. 3
   b. 5
   c. 4
   d. 2
   e. 1

5.
   a. Parallel
   b. Serial
   c. Ten
   d. Rear
   e. Ball-point pen
   f. Off

6. The connection should be a 36-pin connection for a parallel interface

7. The connections should be a 25-pin connection for a serial interface

8.
   a. CN4
   b. CN1
   c. Control drive board
   d. CN2
   e. CN9
   f. CN8
   g. Fuse board

ANSWERS TO TEST

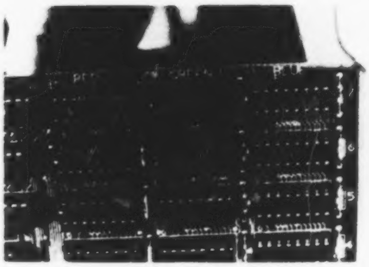
9. a. Status
   b. WP
   c. PM

10. a. 2
    b. 3
    c. 1

11. a. Four
    b. ¼
    c. Three

12. a. 4
    b. 6
    c. 1
    d. 3
    e. 5
    f. 2

13. Performance competencies evaluated according to written procedures in the job sheets



SERVICING AND REPAIRING COMPUTER MONITORS
UNIT IV

UNIT OBJECTIVE

After completion of this unit, the student should be able to discuss types of computer monitors, discuss their characteristics, and trace red, green, and blue color signals through monitor circuitry. The student should also be able to check power supply and operating voltages on a monitor, discharge high voltage from a CRT, and troubleshoot color signals from the host computer to the final display. These competencies will be evidenced by correctly performing the procedures outlined in the job sheets and by scoring 85 percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms related to servicing and repairing computer monitors with their correct definitions.
2. Complete a list of prerequisites recommended for monitor service technicians.
3. Complete statements concerning hazards and dangers of working with CRT's.
4. Select true statements concerning general characteristics of computer monitors.
5. Complete a list of sections of a monitor.
6. Select true statements concerning types of monitors.
7. Complete statements concerning modular structure in a typical RGB monitor.
8. Select true statements concerning the high voltage and horizontal sweep module.
9. Arrange in order the steps in the formation of a color CRT picture.
10. Select true statements concerning the importance of convergence in RGB monitors.

OBJECTIVE SHEET

11. Complete statements concerning how a CRT yoke works.

12. Complete statements concerning how a standard television scanning pattern works.

13. Differentiate between monitor control devices.

14. Demonstrate the ability to:

    a. Use a CRT display to evaluate monitor problems. (Job Sheet #1)

    b. Discharge high voltage from a CRT and make a sensory check of the monitor. (Job Sheet #2)

    c. Check the power supply and operating voltages on a monitor. (Job Sheet #3)

    d. Troubleshoot monitor picture problems related to voltage. (Job Sheet #4)

    e. Check the sweep signal on a color monitor. (Job Sheet #5)

    f. Troubleshoot RGB and monochrome signals on a computer monitor. (Job Sheet #6)

SERVICING AND REPAIRING COMPUTER MONITORS
UNIT IV

SUGGESTED ACTIVITIES

A. Provide student with objective sheet.

B. Provide student with information and job sheets.

C. Make transparency.

D. Discuss information sheet.

E. Discuss and demonstrate the procedures outlined in the job sheets.

F. Have a monitor available to demonstrate the steps for safely discharging high voltage from a CRT as presented in Job Sheet #2, the procedure for checking high voltages as presented in Job Sheet #3, and emphasize the extra care required when working with monitors.

G. Invite a local or area television service technician to talk to the class about general TV repair and how it is similar but different from servicing and repairing computer monitors.

H. Check your school for monitors that need repair, and order OEM schematics or Computerfacts™ for the monitors that you plan for the students to troubleshoot and repair.

I. Give test.

CONTENTS OF THIS UNIT

A. Objective sheet

B. Information sheet

C. Transparency Master 1 — Modular Structure in an RGB Monitor

D. Job sheets

  1. Job Sheet #1 — Use a CRT Display to Evaluate Monitor Problems
  2. Job Sheet #2 — Discharge High Voltage from a CRT and Make a Sensory Check of the Monitor
  3. Job Sheet #3 — Check the Power Supply and Operating Voltages on a Monitor
  4. Job Sheet #4 — Troubleshoot Monitor Picture Problems Related to Voltage
  5. Job Sheet #5 — Check the Sweep Signal on a Color Monitor
  6. Job Sheet #6 — Troubleshoot RGB and Monochrome Signals on a Computer Monitor

CONTENTS OF THIS UNIT

E. Test

F. Answers to test

REFERENCES USED IN DEVELOPING THIS UNIT

A. Groves, Bernard. *Basic Television Principles and Servicing.* New York, NY: McGraw Hill Book Company, 1975.

B. *SAMS Computerfacts™ CSCS2 COMPUTER: IBM® PC5150.* Indianapolis, IN 46206: Howard W. Sams & Co., Inc., 1985.

C. *SAMS Computerfacts™ CSCS4 COMPUTER: TRS-80® III.* Indianapolis, IN 46206: Howard W. Sams & Co., Inc., 1985.

D. *Service Manual SR-12 Manual.* Princeton, NJ 08540: Princeton Graphic Systems, 1984.

E. *Technical Training ZVM-131 & ZVM-135 Color Monitors.* Saint Joseph, MI 49085: Zenith Data Systems, 1981.

F. Tinnell, Richard W. *Television Symptom Diagnosis, An Entry into TV Servicing.* Indianapolis, IN 46268: Howard W. Sams & Co., Inc., 1977.

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SERVICING AND REPAIRING COMPUTER MONITORS
UNIT IV

INFORMATION SHEET

I. **Terms and definitions**

   A. CRT — Cathode ray tube

   B. RGB — Red, green, blue

   C. Hi res — An abbreviation of high resolution

   D. Implode — To burst inward as opposed to exploding or bursting outward

   E. Monochrome — One color

   F. Hybrid — The mixture of two things into a product or process that exhibits characteristics of both original components

II. **Prerequisites recommended for monitor service technicians**

   A. Training in analog circuitry

      1. To work with amplifiers and oscillators found in the analog circuitry of monochrome monitors or television sets used as monitors

      2. To work with monitor power supplies, especially the high voltage power supplies

   B. Fundamentals of servicing high resolution monitors

   C. Fundamentals of servicing color television sets used as microcomputer monitors

   D. Training in oscilloscope signal diagnosis

   (NOTE: Effective color television servicing requires training in that particular area.)

III. **Hazards and dangers of working with CRT's**

   A. The voltage that accelerates the electron beam is found on the surface of the tube immediately behind the screen, and since the voltage is extremely high, NEVER TOUCH THE BACK OF A CRT BEFORE DISCHARGING

   B. CRT's are actually fragile pieces of glass that have been highly evacuated to form an inner negative pressure, and because of this, CRT's are literally BOMBS that will implode and scatter hazardous glass particles if broken or dropped, so NEVER DROP A CRT

   C. Wear safety glasses when working around a CRT whether it is in or out of its case

INFORMATION SHEET

IV. **General characteristics of computer monitors**

A. Monitors usually contain both analog and digital circuitry, and earlier monitors are largely dominated by analog circuitry

B. The amplifiers that control information flow in some monitors are analog devices and subject to potential errors:

1. They can change in response to a supply voltage change

2. They can change (drift) as temperature changes

3. They can change in response to the presence of other electrical signals in the area

C. Because analog circuitry is so subject to error, digital circuitry is used and will be used in more monitors because:

1. Virtually none of the influences that can change an analog signal can affect a digital signal

2. Because a digital signal carries information at two discrete levels packaged in digital code form, the information can be transmitted in the presence of error checking codes to verify that the information is correct

D. Technicians need to keep in mind the analog/digital complexity and realize that although more digital structure is being used in monitors, most monitors currently on the market are hybrids

V. **Sections of a monitor**

A. The power supply must supply two types of power:

1. A +5V DC power supply to the digital parts

2. A larger DC voltage supply to the analog circuitry, including high voltage for the operation of the CRT scanning beam which requires 20,000 to 30,000 volts

B. Control section which may be analog or digital:

1. The newer systems will be digital

(NOTE: Most of the objectives in this unit of instruction treat the digital elements of monitors.)

2. The control circuitry is largely made up of IC's, and in many cases is TTL logic based or MOS logic based

INFORMATION SHEET

3. The newer control sections are LSI MOS circuit packages

4. Control section must integrate all of the picture information with the scanning information, and do it at the proper time

   (NOTE: The importance of integrating and timing signals is a major control function and will be treated at other points in this information sheet.)

VI. **Types of monitors**

A. Probably the most common type of monitor is the no color or hi res monochrome monitor that is black and white, green, or amber

B. The screen color variation in a monitor is totally a CRT function, and changing to a green or amber monitor means changing CRT's because the color is in the phosphor on the face of the CRT screen

C. A color monitor may be one that uses a composite signal derived from the video part of the signal from a television set or a color monitor that uses separate red, green, and blue signals (RGB)

D. Knowing how to service an RGB monitor will cover a lot of troubleshooting needs because the monochrome signal is a subset of the color signal

VII. **Modular structure in a typical RGB monitor** (Transparency 1)

A. The RGB major module may be separate, may be an interface module, or may be part of one board that controls other functions

B. The RGB major module receives the incoming sync and video information from the host microcomputer

C. The RGB major module will in turn produce the horizontal drive and vertical drive signals that go on to the high voltage, horizontal sweep module, and vertical sweep circuitry

D. High voltages for CRT power purposes are derived from the high voltage and horizontal sweep module information

   (NOTE: In short, the power for logic functions and the 150V power for the horizontal sweep functions are a product of power exchanged between the two modules.)

E. The video signal is split off at this point, but it comes back together with the horizontal and vertical drive signals on the face of the screen

F. A video color signal actually contains three separate red, green, and blue signals which drive the three separate color guns

INFORMATION SHEET

VIII. **The high voltage and horizontal sweep module** (Figure 1)

A. The high voltage required for operation of the CRT is generated by creating a high frequency and stepping it up in a special transformer, and providing that voltage to the CRT

(**CAUTION:** Voltages normally used by the CRT are 20,000V and up, so you can see why working around a CRT poses a great danger.)

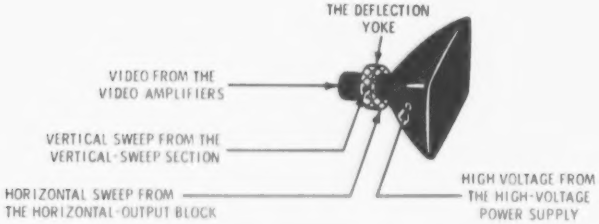
B. Horizontal and vertical sweep information is sent to the yoke of the CRT in the form of current signals

C. The yoke is a set of coils that through magnetic influence move the electron beam on the face of the CRT by changing the horizontal and vertical drive signals into current that can drive the yoke coils

D. Coils are set 90° to their function so that a vertically-placed coil drives horizontal sweep and a horizontally-placed coil drives vertical sweep

(NOTE: It is important to remember how the coils are set and that the current drive on the coils is an analog, not a digital, function.)

FIGURE 1


THE DEFLECTION YOKE
VIDEO FROM THE VIDEO AMPLIFIERS
VERTICAL SWEEP FROM THE VERTICAL-SWEEP SECTION
HORIZONTAL SWEEP FROM THE HORIZONTAL-OUTPUT BLOCK
HIGH VOLTAGE FROM THE HIGH-VOLTAGE POWER SUPPLY

Courtesy Howard W. Sams & Co., Inc.

IX. **Steps in the formation of a color CRT picture**

A. The cathode emitting surface of the CRT is heated with a heating element so that the cathode gives off electrons which are negative

B. The electrons liberated from the cathode are attracted away from the cathode with a high positive voltage

C. Electron-forming devices in the CRT shape the clusters of electrons into a very tight beam in an assembly called an electron gun

D. As the tight beam of electrons leaves a gun assembly, the beam is accelerated toward the face of the CRT by an extremely high voltage that may range from 20,000V to 45,000V

INFORMATION SHEET

E. A high positive voltage attracts the beam to the face of the CRT where the beam hits the phosphor on the face of the CRT and raises the energy level of the phosphor

F. The electrons that raise the energy level of the phosphor give up energy in the form of light and fall back to a previous energy level, but that energy emerges from the CRT in the form of light in a color peculiar to that certain phosphor

G. Since different phosphors give off different wave lengths of light, the CRT presentation is in red, green, and blue or the colors made from those colors

(NOTE: The same process happens in a monochrome CRT except that the electron beam comes from only one gun instead of three.)

X. The importance of convergence in RGB monitors

A. With a color signal, each electron beam has to strike the screen at an exact location, and a specific red, green, or blue dot within that location

B. To help guide the separate beams, there's a mask behind the CRT phosphors, and the mask is much like a pinhole behind each of the three-dot clusters

C. For a specific color to be seen in a specific location on the CRT, the beams have to converge at a specific location in the pinhole mask

D. Since resolution is based on the number of locations per line, the higher the resolution the more locations, and the more locations, the more red, green, and blue dots are required

(NOTE: 640 locations on a line with three dots per location is fairly standard with hi res color monitors, so you can see the importance that convergence plays in the operation.)

XI. How the CRT yoke works

A. The beam created at the gun and accelerated toward the screen must be moved from place to place in order to paint a picture on the screen

B. Magnetic fields created in the yoke of the CRT sweep the beam across the screen so the beams can hit specific locations in what is called a scanning pattern

C. Scanning patterns may vary from ordinary television sets and microcomputer monitors, but there is an industry attempt to keep the scanning patterns set to the NTSC standard

INFORMATION SHEET

XII. **How a standard television scanning pattern works** (Figure 2)

A. The raster is the pattern of lines created on a CRT when there is no video signal

B. The standard television scanning pattern is a total of 525 horizontal scanning lines in a rectangular frame with a 4 × 3 aspect

(NOTE: The 4 × 3 aspect means the rectangular frame has four increments of width to three increments of height.)

C. When one complete rectangular picture is formed, it's called a scanning frame, and the standard scanning pattern has 30 frames per second

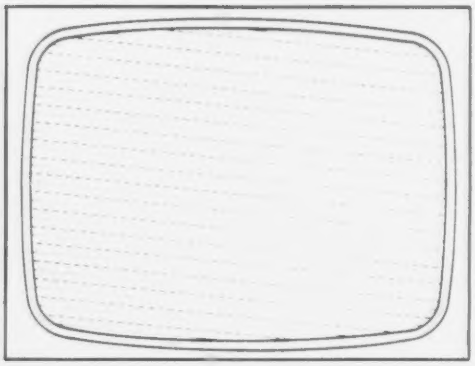
D. Since the brain can barely detect 30 frames per second, the scanning pattern fools the brain by breaking the frame into two fields at 60 frames per second

E. The first field in the frame traces through the entire frame in 1/60 of a second and covers 262 1/2 lines with the odd lines first (1, 3, 5, 7, etc.)

F. The second field in the frame traces through the entire frame in 1/60 of a second and covers 262 1/2 lines with the even lines first (2, 4, 6, 8, etc.)

G. Interlacing the even/odd parts of the frame give the full 525 horizontal scanning lines in the standard scanning pattern

FIGURE 2



Courtesy Howard W. Sams & Co., Inc.

INFORMATION SHEET

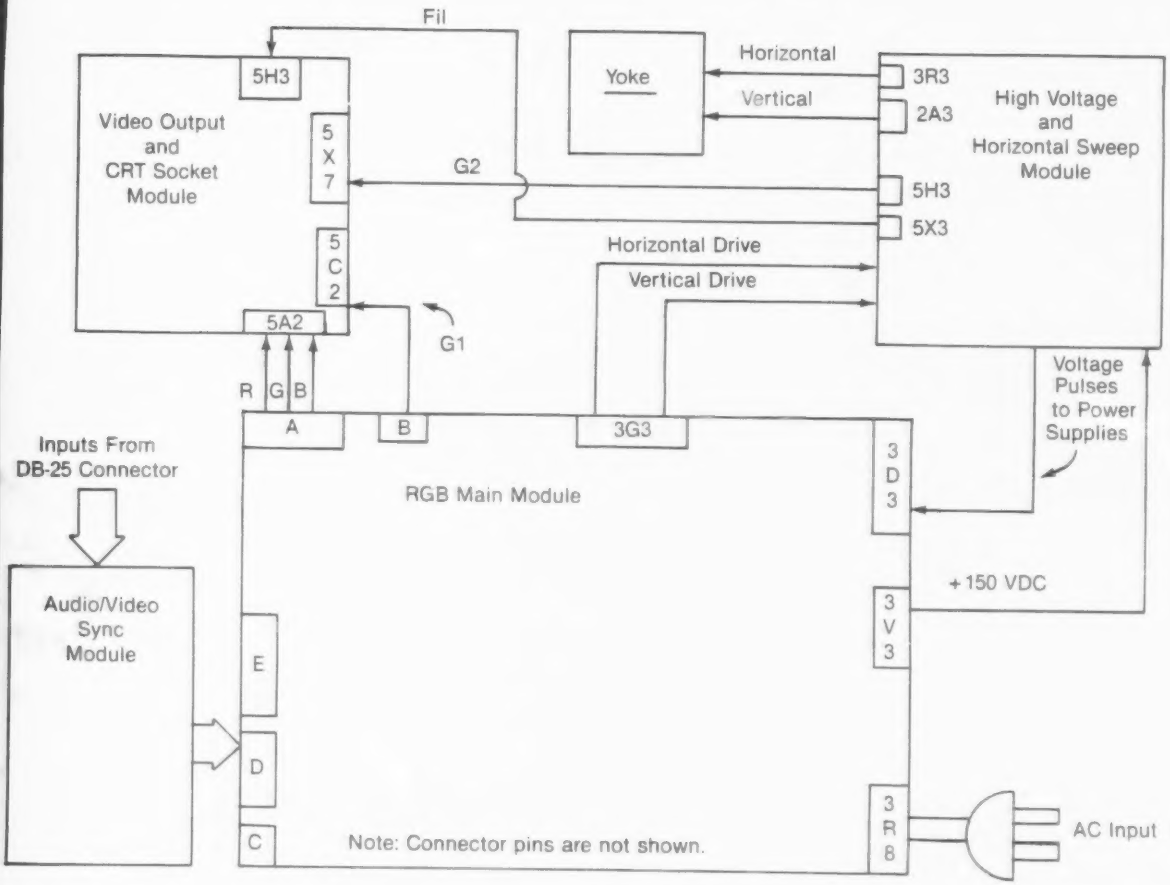
XIII. **Monitor control devices**

A. Contrast control — Creates a relative difference in brightness between the background and the characters on the screen

B. Brightness control — Controls the intensity of the beam striking the screen and works like a rheostat on an ordinary light because the higher you turn it, the brighter it gets

(NOTE: The brightness control in some monitors is sometimes accomplished by making the gun end several thousand volts negative instead of making the anode positive volts, and this helps accelerate voltage from the gun to the CRT screen, but it's important for a troubleshooter to know if the brightness control is set up this way.)

Modular Structure in an RGB Monitor



Fil
5H3
Video Output
and
CRT Socket
Module
5X7
5C2
5A2
Yoke
Horizontal
Vertical
3R3
2A3
5H3
5X3
High Voltage
and
Horizontal Sweep
Module
G2
Horizontal Drive
Vertical Drive
G1
R G B
A
B
3G3
Voltage
Pulses
to Power
Supplies
Inputs From
DB-25 Connector
RGB Main Module
3D3
+150 VDC
3V3
Audio/Video
Sync
Module
E
D
C
3R8
AC Input

Note: Connector pins are not shown.

Courtesy Zenith Data Systems

MPST - 449

SERVICING AND REPAIRING COMPUTER MONITORS
UNIT IV

JOB SHEET #1 — USE A CRT DISPLAY TO EVALUATE MONITOR PROBLEMS

A. Tools and equipment

1. Monitor as selected by instructor
2. Pencil and paper
3. Software for operating system
4. Host microcomputer and software
5. OEM technical material or Computerfacts™

B. Procedure

1. Sign on your troubleshooting log and be sure to save the log for other job sheets that follow
2. Turn on the host microcomputer and the monitor in the order recommended by the OEM
3. Load monitor-evaluating software, if it is available, or load software that will put up a display on the CRT screen
4. Check first for no picture at all
    a. If there is no picture, try another monitor to make sure the signal is arriving properly from the host microcomputer
    b. If the signal is okay, hook up the malfunctioning monitor again and try increasing the brightness and contrast
    c. If a raster appears on the screen, the sweep circuitry is probably okay, but the video signal is faulty and will require troubleshooting

    (NOTE: With some microcomputers such as the ITT Extra, the host computer supplies the voltage for the display module as well as sweep and picture information; this can sometimes mean that the host microcomputer will require checking.)
5. Check next for a picture that is too small or too large to properly fill the screen
    a. If the picture does not fit on the screen, it may mean an adjustment has been inadvertently changed or damaged

JOB SHEET #1

   b. An improperly sized picture can also mean that voltage to the circuitry that controls picture size is incorrect

   c. If the picture shrinks (does not fill the screen), check the power supply or the regulator within the power supply because diminished voltage would literally fail to drive the picture to the edge of the screen

6. Check for a picture that is torn

   a. This almost always means a malfunction in the horizontal sync control circuitry

   b. It can also mean a problem with both the horizontal and vertical sync controls because the two are closely related and the problems are sometimes hard to separate

7. Check for a picture that rolls

   a. This may mean a loss of vertical sync

   b. It could indicate that a control has been inadvertently changed and needs to be reset

   c. If adjusting a control does not cure the problem, check the vertical sync circuitry

8. Check for no raster (Figure 1)

   a. This indicates a high voltage failure because screen cannot light up without high voltage to drive the CRT beam

JOB SHEET #1

b. Refer to Job Sheet #4 for other problems related to voltage

FIGURE 1

Courtesy Howard W. Sams & Co., Inc.

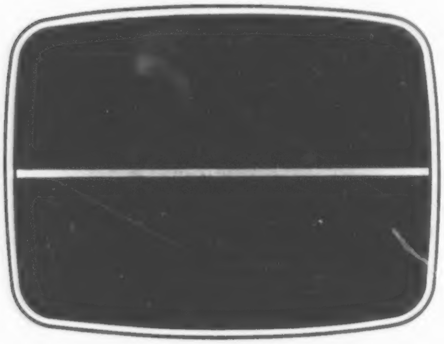
9. Check for a picture with complete loss of height (Figure 2)

    a. This indicates no vertical sweep at all

    b. Can happen if any of the stages in the vertical sweep section fail or if the oscillator fails

    c. Refer to Job Sheet #5 for other problems related to sweep

FIGURE 2



Courtesy Howard W. Sams & Co., Inc.

JOB SHEET #1

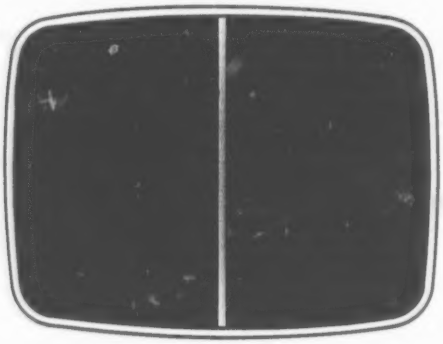
10. Check for a picture with no horizontal sweep (Figure 3)

    a. This usually means there is an open circuit in the horizontal coils of the deflection yoke

    b. It can also mean a horizontal oscillator failure

    c. Refer to Job Sheet #5 for other problems related to sweep

    FIGURE 3



Courtesy Howard W. Sams & Co., Inc.

11. Check for a picture out of sync horizontally (Figure 4)

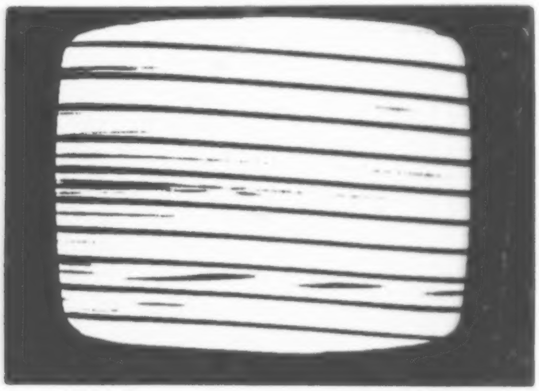
    a. If the horizontal-hole control is ineffective, the problem is probably the horizontal oscillator

    b. The problem may also be in the horizontal sync circuitry

JOB SHEET #1

c. Refer to Job Sheet #5 for other problems related to sweep

FIGURE 4



12. Write your findings on a piece of paper

    ☐ Have your instructor check your work

13. Clean up area and return tools and equipment to proper storage, or prepare for next job as directed by your instructor

JOB SHEET #1

Troubleshooting and Repair Log

Customer's Name ______________________________ Invoice ________________

Date __________________ Equipment and Serial # ___________________________

Complaint ____

____

Technician's Name & ID #	Date	Time On	Time Off	Work Performed	Replacement Parts Used & Inventory #

SERVICING AND REPAIRING COMPUTER MONITORS
UNIT IV

JOB SHEET #2 — DISCHARGE HIGH VOLTAGE FROM A CRT AND MAKE A SENSORY CHECK OF A MONITOR

A. Tools and equipment

1. Monitor as selected by instructor
2. OEM schematic or Computerfacts™
3. Hand tools and a clip lead
4. DVOM
5. Dual-trace oscilloscope
6. High voltage probe

B. Procedure

(**CAUTION:** This procedure should be executed only in the presence of your instructor, and no future attempt to discharge high voltage from a CRT should be made without your instructor's permission.)

1. Sign on your troubleshooting log
2. Make sure the monitor is unplugged from the host computer and from its power source
3. Follow the OEM instructions for removing the screws from the monitor case
4. Check once again to make sure everything is unplugged
5. Discharge the CRT high voltage with the following procedure, and work with caution:
    a. Select a screwdriver that has a well insulated handle, and a clip lead
    b. Clip one end of the clip lead to the metal chassis of the monitor
    c. Clip the other end of the clip lead to the metal shaft on the screwdriver
    d. Locate the spot where the high voltage lead makes contact with the anode of the CRT

    (NOTE: Ask your instructor for help if you need it, but this point should be easy to find because the high voltage lead is usually larger than any other wires, and it usually has an insulated cover.)

JOB SHEET #2

e. BRACE YOURSELF FOR A LOUD POPPING SOUND, and, if the contact point of the high voltage lead and the anode is uninsulated, THERE WILL ALSO BE A BRIGHT ARC

f. Make sure you are holding the insulated handle of the screwdriver, then slip the blade of the screwdriver under the insulated cover so that it makes contact with the high voltage lead/anode connection

g. Remove the screwdriver blade as soon as the loud popping sound ends

☐ Have your instructor check your work

h. Complete a sensory check of the monitor at this point

1) Look for capacitors that are blown open

2) Look for any parts that appear to be burned

3) Be alert for the distinct smell of a burned out transformer

4) Be alert for the smell of a capacitor that is overheating

i. Refer to the schematic to identify and list the replacement parts that will be required

j. Sign off your troubleshooting log

☐ Have your instructor check your work

k. Clean up area and return tools and equipment to proper storage, but leave the monitor case off until later job sheets have been completed

(NOTE: Anytime a monitor has been plugged in for voltage checks or for any other purpose, the CRT high voltage must be discharged before attempting any other troubleshooting or repair activity.)

SERVICING AND REPAIRING COMPUTER MONITORS
UNIT IV

JOB SHEET #3 — CHECK THE POWER SUPPLY AND OPERATING VOLTAGES ON A MONITOR

A. Tools and equipment

1. Monitor as selected by instructor
2. OEM schematics or Computerfacts™
3. Hand tools
4. DVOM
5. Dual-trace oscilloscope
6. High voltage test probe
7. Troubleshooting log (from previous job sheet)
8. Pencil and paper

B. Procedure

1. Sign on your troubleshooting log
2. Check the schematic and identify the voltage test points out of the power supply

   (NOTE: Figure 1 contains the schematic for a Princeton Graphics SR-12 RGB monitor to serve as a backup reference for this job sheet, so check it now and note that there are three voltages coming out of the power supply.)

3. Plug the monitor in and remember that while checking power supply and operating voltages you will be working with potentially hazardous voltages, so work with CAUTION
4. Turn the monitor power ON
5. Check the input power supply voltage to the power supply itself at the points where it enters the transformer

   (NOTE: In the SR-12, these points are D801 and D803.)

6. Check the output voltages of the power supply

   (NOTE: On the SR-12, these voltages include +5V, and then 90V at TR4, but to get an idea of how voltage can vary from monitor to monitor, the Zenith color monitor has 150V at the equivalent point where the SR-12 has 90V, so this is another good example of why a schematic is required to troubleshoot a monitor.)

7. Check for voltages at the power supply regulators

   (NOTE: With the SR-12, there should be a 15V reading at pin 3 of the 7815 regulator, and a 5V reading at the output of pin 3 of the 7805 regulator, and note that the regulator voltages are indicated in the last two digits of the regulator numbers because this is the way regulators in the 7800 series are identified.)

JOB SHEET #3

8. Check the circuitry that is being driven by the 15V out of the regulator to see if the load is shorted and causing the power supply to go to ground

   (NOTE: When a load is shorted, it will make the power supply appear to have the wrong voltage, so anytime you're working with a power supply that is not a switching power supply, disconnect the load and if the power supply is restored, the problem is in the load, not the power supply, and this is a form of half-splitting that is handy for monitor troubleshooting.)

9. Make a record of all your preliminary voltage checks and indicate problem areas that will require further troubleshooting

   ☐ Have your instructor check your work

10. Read carefully the following standard procedure for checking high voltage readings:

    a. Turn the power OFF
    b. While you're waiting for about two minutes, set the correct range and polarity on the DVOM or high voltage probe
    c. Connect the ground lead first
    d. Connect the positive lead last
    e. Keep your hands off the meter and the leads both and turn the power ON
    f. Read the meter
    g. Keep your hands off the meter and the leads both and turn the power OFF
    h. Record the reading you made
    i. Disconnect both leads

11. Use the procedure outlined in Step 10 to check the output from the horizontal transistor

    (NOTE: On the SR-12, this reading should be 920V, and be sure your DVOM will handle this voltage, and if it won't, use a high voltage probe.)

12. Record your reading

13. Check the CRT heater voltage and record it

14. Check the CRT screen voltage and record it

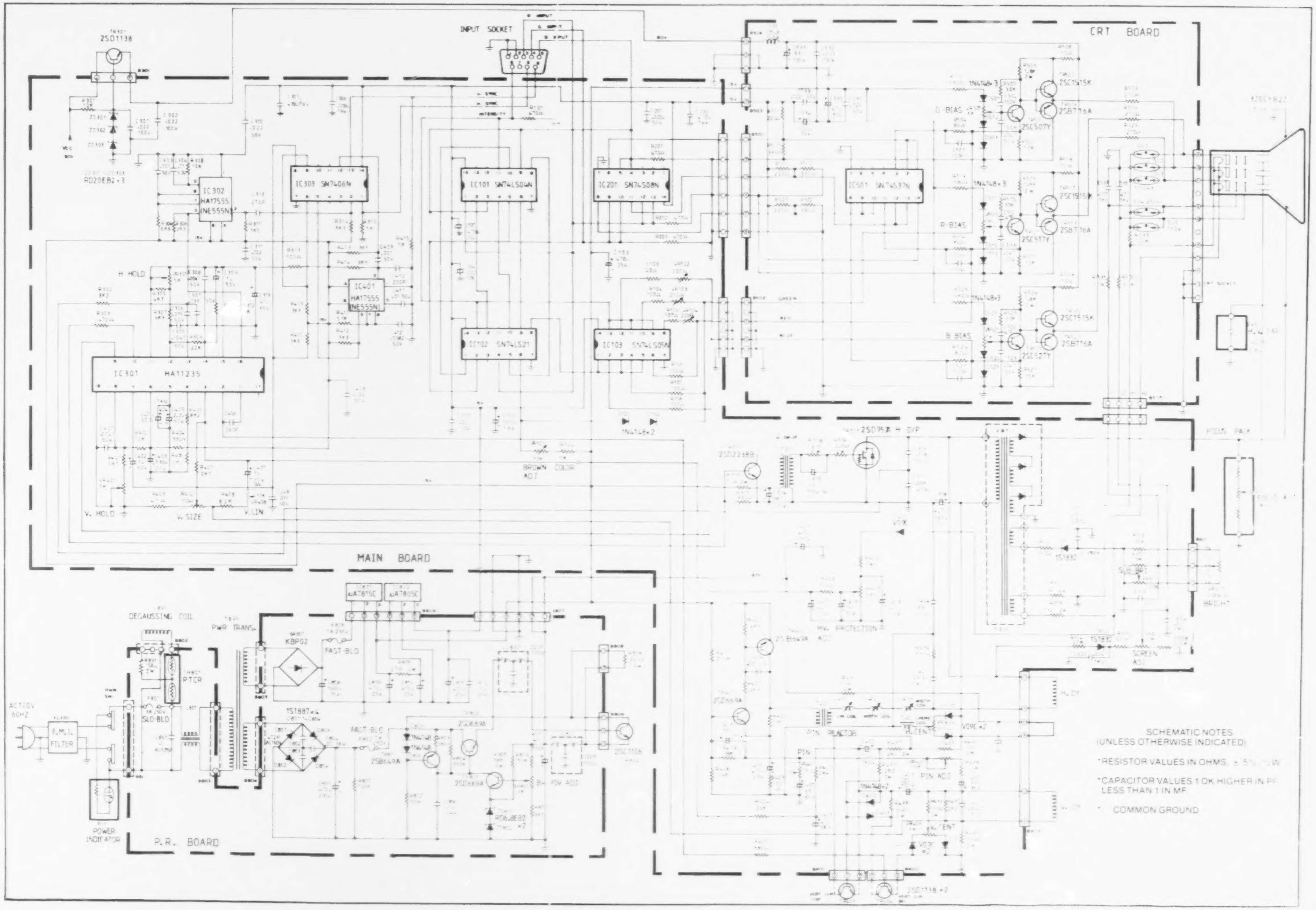
    (NOTE: On the SR-12, the screen voltage should read 400V.)

    ☐ Have your instructor check your voltage readings, and compare the readings against the readings shown in the schematics

15. Sign off your troubleshooting log

16. Clean up the area and return tools and equipment to proper storage, or prepare for next job sheet as directed by your instructor

JOB SHEET #3


INPUT SOCKET
2SD1138
RD20EB2×3
IC302 HA17555 (NE555N)
IC303 SN7406N
IC101 SN74LS04N
IC201 SN74LS08N
IC501 SN74S37N
CRT BOARD
G BIAS
2SC1515K
2SB716A
2SC507Y
1N4148×3
R-BIAS
2SC517Y
B BIAS
2SC527Y
H HOLD
IC401 HA17555 (NE555N)
IC102 SN74LS21
IC103 SN74LS05N
GREEN
RED
BLUE
IC301 HA11235
1N4148×2
BROWN ADJ
COLOR
V. HOLD
V. SIZE
V. LIN
2SD2218B
2SD957A H. O/P
FOCUS PACK
MAIN BOARD
μA7815C
μA7805C
DEGAUSSING COIL
PWR TRANS.
KBP02
FAST-BLO
PTCR
AC120V 60HZ
E.M.I. FILTER
PWR SW
SLO-BLO
1S1887×4
FAST-BLO
2SB649A
2SD669A
2SC1106
RD6.8EB2
B+ 'ADJ
POWER INDICATOR
P.R. BOARD
2SB649A
H.V. PROTECTION
1S1832
SUB BRT
BRIGHT
1S1835
SCREEN ADJ
H. DY
2SD669A
PIN REACTOR
H. CENT
VD9C×2
PIN
PIN ADJ
1N4148×2
V. CENT
VD9C×2
V. DY
2SD1118×2

SCHEMATIC NOTES
(UNLESS OTHERWISE INDICATED)

*RESISTOR VALUES IN OHMS, ± 5%, ¼W

*CAPACITOR VALUES 1.0K HIGHER IN PF
LESS THAN 1 IN MF

* COMMON GROUND

FIGURE 1

BEST COPY AVAILABLE

SERVICING AND REPAIRING COMPUTER MONITORS
UNIT IV

JOB SHEET #4 — TROUBLESHOOT MONITOR PICTURE PROBLEMS REALTED TO VOLTAGE

A. Tools and equipment

1. Monitor as selected by instructor
2. OEM schematics or Computerfacts™
3. Hand tools
4. DVOM
5. Dual-trace oscilloscope
6. Troubleshooting log (from previous job sheet)
7. Pencil and paper

B. Procedure

1. Sign on your troubleshooting log

   (NOTE: This job sheet makes specific references to the Princeton Graphics SR-12 RGB monitor and the schematic from Job Sheet #3, so if you're working with a different monitor and schematic, make comparisons and use equivalent test points.)

2. Check for a reading of 60V at TR301

   a. If it is okay, move on to the next checkpoint

   b. If it is not okay, replace the transistor because it controls one of the supply voltages to the CRT

3. Check for a 5V output on pin 3 of the 5V regulator

   a. If it is okay, move on to the next checkpoint

   b. If it is not okay, check the power into the regulator

   c. If power into the regulator is okay, then replace the regulator because this is the voltage that runs the TTL circuitry to the CRT

JOB SHEET #4

4. Check for 5V readings on all of the TTL IC's related to the CRT, which means IC's 101, 102, 103, 201, and 501
   a. If all are okay, move on to the next checkpoint
   b. If voltages are not okay, replace as required
5. Check the 15V reading at the B502 connector
   a. If it is okay, move on to the next checkpoint
   b. If it is not okay, check the feedback loop in the RGB bias circuits
6. Check the three CRT cathode voltages, one for red, one for green, and one for blue
7. Check the G1 and G2 voltages
   a. If all the voltages in Step 4 and Step 5 are okay, the CRT may have failed and should be checked for replacement
   b. Record your findings
8. Sign off your troubleshooting log

   ☐ Have your instructor check your work, including the record of your findings
9. Clean up area and return tools and equipment to proper storage, or prepare for next job sheet as directed by your instructor

SERVICING AND REPAIRING COMPUTER MONITORS
UNIT IV

JOB SHEET #5 — CHECK THE SWEEP SIGNAL ON A COLOR MONITOR

A. Tools and equipment

1. Monitor as selected by instructor
2. OEM schematics or Computerfacts™
3. Hand tools
4. DVOM
5. Dual-trace oscilloscope
6. Troubleshooting log (from previous job sheet)
7. Pencil and paper

B. Procedure

1. Sign on your troubleshooting log
2. Unplug the monitor from the host system and from its power supply
3. Remove the monitor case as outlined in a previous job sheet
4. Restore power supply and turn it on
5. Complete voltage checks as outlined in a previous job sheet
6. Check the voltages around the vertical sweep circuitry to make sure they agree with voltages indicated on the schematic

    a. If the voltages are present, use the oscilloscope to check the output of the vertical sweep circuits and compare the waveforms with the waveforms pictured in the schematics

    b. If the voltages are present, but the waveforms are not, then check the transistors, capacitors, and resistors in the vertical sweep oscillator

    (NOTE: Failure of vertical sweep may also be a yoke problem, and there are distinct waveforms that will differentiate a yoke problem from a voltage problem, but you will have to reference a TV repair manual to find what a yoke problem looks like, so check with your instructor.)

JOB SHEET #5

7. Check voltages around the horizontal sweep oscillator to make sure they agree with voltages shown on the schematic

   (**CAUTION:** These are potentially hazardous voltages so work with caution, but verify that these voltages are okay before moving on to the next step.)

8. Check the horizontal sweep waveforms, but this is an EXTREMELY DANGEROUS PROCEDURE, so read the following before going any farther:

   a. These waveforms can be checked at places that will minimize the hazard

   b. The secret is to find the output of the horizontal oscillator BEFORE IT BECOMES HIGH VOLTAGE

   c. This should be indicated on the schematic, but CHECK WITH YOUR INSTRUCTOR BEFORE MAKING ANY WAVEFORM EVALUATION

9. Check for other abnormal picture problems

   (NOTE: Refer to Job Sheet #1 for help with identifying the CRT display to evaluate monitor problems.)

10. Record your findings and use the schematic to identify any parts that have to be replaced

    ☐ Have your instructor check your work

11. Clean up area and return tools and equipment to proper storage, or prepare for next job sheet as directed by your instructor

SERVICING AND REPAIRING COMPUTER MONITORS
UNIT IV

JOB SHEET #6 — TROUBLESHOOT RGB AND MONOCHROME SIGNALS ON A COMPUTER MONITOR

A. Tools and equipment

1. Monitor as selected by instructor
2. OEM schematics or Computerfacts™
3. Hand tools
4. DVOM
5. Dual-trace oscilloscope
6. Troubleshooting log (from previous job sheet)
7. Pencil and paper

B. Procedure

1. Sign on your troubleshooting log
2. Unplug the monitor from the host system and from its power supply
3. Remove the monitor case as outlined in a previous job sheet
4. Complete voltage checks as outlined in a previous job sheet
5. Hook the monitor back to the host system and turn the microcomputer and monitor ON in the order recommended by the OEM
6. Refer to OEM schematics or the Computerfacts™ schematic to identify checkpoints and signals

   (NOTE: When signals cannot be identified on a schematic, readings should be taken on a known good monitor, waveforms should be photographed with an oscilloscope camera, and all should be filed for use in future troubleshooting.)
7. Check the RGB or monochrome signal where it enters the monitor from the host computer
8. Trace the signal on to the color separator or color matrix circuit
9. Check the input signal at the color separator or color matrix, then check the output signal, and if the signal doesn't come out, replace that part of the circuitry
10. Trace the RGB signals through the buffers that separate the color matrix circuits from the RGB circuits

    (NOTE: There will probably be no evidence of change in the signals at this point.)

JOB SHEET #6

11. Check the RGB drive transistors by following the individual RGB signals out of the buffers

12. Check the individual RGB signals out of the drive transistors as they go into the output transistors

13. Apply the following guidelines for checking the red signal as you check both the green and blue signals:

    a. When the red signal leaves the color matrix it will go first through a buffer and there should be no significant change from input to output

    b. The red signal will next go into the red drive transistor circuitry and there should be a voltage level change, probably an increase

    c. From the red drive transistor, the red signal will go into a red output transistor

    d. From the red output transistor, the red signal will go to the CRT, and at this point there may be an increase in current that cannot be seen on the oscilloscope because most oscilloscopes will not measure current

    e. The drive transistor and the output transistor complement each other because the drive transistor creates the voltage and the output transistor increases the current so that the two together provide the power required to drive the gun

14. Complete a check of the green and blue signals

15. Record all your findings

    ☐ Have your instructor check your work

16. Sign off your troubleshooting log

17. Unplug the monitor from the host system and from its power supply and put the monitor case back

18. Clean up area and return tools and equipment to proper storage

SERVICING AND REPAIRING COMPUTER MONITORS
UNIT IV

NAME ________________________

TEST

1. Match the terms on the right with their correct definitions.

    ______a. Cathode ray tube

    ______b. Red, green, blue

    ______c. An abbreviation of high resolution

    ______d. To burst inward as opposed to exploding or bursting outward

    ______e. One color

    ______f. The mixture of two things into a product or process that exhibits characteristics of both original components

    1. Hi res
    2. Hybrid
    3. CRT
    4. Monochrome
    5. RGB
    6. Implode

2. Complete a list of prerequisites recommended for computer monitor technicians by inserting the word(s) that best completes each statement.

    a. Training in ____________ circuitry

        1) To work with amplifiers and oscillators found in the ____________ circuitry of monochrome monitors or television sets used as monitors

        2) To work with monitor ____________ ____________, especially the high voltage ____________ ____________

    b. Fundamentals of servicing ____________ ____________ monitors

    c. Fundamentals of servicing ____________ television sets used as microcomputer monitors

    d. Training in ____________ signal diagnosis

3. Complete statements concerning hazards and dangers of working with CRT's by circling the word(s) that best completes each statement.

    a. The voltage that accelerates the electron beam is found on the surface of the tube (**down near the yoke, immediately behind the screen**) and since the voltage is extremely high, NEVER TOUCH THE BACK OF A CRT

    b. CRT's are actually fragile pieces of glass that have been highly evacuated to form an inner negative pressure, and because of this, CRT's are literally BOMBS that will (**implode, explode**) and scatter hazardous glass particles if broken or dropped, so NEVER DROP A CRT

    c. Wear (**gloves, safety glasses**) when working around a CRT whether it is in or out of its case

TEST

4. Select true statements concerning general characteristics of computer monitors by placing an "X" in the appropriate blanks.

   (NOTE: For a statement to be true, all parts of the statement must be true.)

   _____a. Monitors usually contain both analog and digital circuitry, and earlier monitors are largely dominated by digital circuitry

   _____b. The amplifiers that control information flow in some monitors are analog devices and subject to potential errors:

   1) They can change in response to a supply voltage change

   2) They can change as temperature changes

   3) They can change in response to the presence of other electrical signals in the area

   _____c. Because analog circuitry is so subject to error, digital circuitry is used and will be used in more monitors because:

   1) Less than half of the influences that can change an analog signal can affect a digital signal

   2) Because a digital signal carries information at two discrete levels packaged in digital code form, the information can be transmitted in the presence of error checking codes to verify that the information is correct

   _____d. Technicians need to keep in mind the analog/digital complexity and realize that although more digital structure is being used in monitors, most monitors currently on the market are strictly analog

5. Complete a list of sections of a monitor by circling the word(s) that best completes each statement.

   a. The power supply must supply two types of power:

   1) A (**+5V, +12V**) DC power supply to the digital parts

   2) A larger DC voltage supply to the (**analog, digital**) circuitry, including high voltage for the operation of the CRT scanning beam which requires 20,000 to 30,000 volts

   b. Control section which may be analog or digital:

   1) The newer systems will be (**digital, analog**)

   2) The control circuitry is largely made up of (**transistors, IC's**), and in many cases is TTL logic

   3) The newer control sections are LSI (MOS) (TTL) circuit packages

   4) Control section must (**separate, integrate**) all of the picture information (**with, from**) the scanning information, and do it at the proper time

TEST

6. Select true statements concerning types of monitors by inserting an "X" in the appropriate blanks.

   ______a. Probably the most common type of monitor is the color monitor

   ______b. The screen color variation in a monitor is totally a CRT function, and changing to a green or amber monitor means changing CRT's because the color is in the phosphor on the face of the CRT screen

   ______c. A color monitor may be one that uses a composite signal derived from the video part of the signal from a television set, or a color monitor that uses separate red, green, and blue signals (RGB)

   ______d. Knowing how to service an RGB monitor will cover a lot of troubleshooting needs because the monochrome signal is a subset of the color signal

7. Complete statements concerning modular structure in typical RGB monitors by inserting the word(s) that best completes each statement.

   a. The ____________ major module may be separate, may be an interface module, or may be part of one board that controls other functions

   b. The RGB major module receives the incoming ____________ and video information from the host microcomputer

   c. The RGB major module will in turn produce the ____________ drive and ____________ drive signals that go on to the high voltage, horizontal sweep module, and vertical sweep circuitry

   d. High voltages for CRT power purposes are derived from the ____________ voltage and ____________ sweep module information

   e. The ____________ signal is split off at this point, but it comes back together with the horizontal and vertical drive signals on the face of the screen

   f. A video color signal actually contains three separate red, green, and blue signals which drive the three separate color ____________

8. Select true statements concerning the high voltage and horizontal sweep module by placing an "X" in the appropriate blanks.

   ______a. The high voltage required for operation of the CRT is generated by creating a high frequency and stepping it up in a special transformer, and providing that voltage to the CRT

   ______b. Horizontal and vertical sweep information is sent to the yoke of the CRT in the form of current signals

   ______c. The yoke is a set of coils that through magnetic influence move the electron beam on the face of the CRT by changing the horizontal and vertical drive signals into current that can drive the yoke coils

   ______d. Coils are set according to their function so that a vertically-placed coil drives vertical sweep and a horizontally-placed coil drives horizontal sweep

TEST

9. Arrange in order the steps in the formation of a color CRT picture by placing the correct sequence number in the appropriate blank.

______a. Since different phosphors give off different wave lengths of light, the CRT presentation is in red, green, and blue or the colors made from those colors

______b. The cathode emitting surface of the CRT is heated with a heating element so that the cathode gives off electrons which are negative

______c. The electrons liberated from the cathode are attracted away from the cathode with a high positive voltage

______d. A high positive voltage attracts the beam to the face of the CRT where the beam hits the phosphor on the face of the CRT and raises the energy level of the phosphor

______e. The electrons that raise the energy level of the phosphor give up energy in the form of light and fall back to a previous energy level, but that energy emerges from the CRT in the form of light in a color peculiar to that certain phosphor

______f. Electron-forming devices in the CRT shape the clusters of electrons into a very tight beam in an assembly called an electron gun

______g. As the tight beam of electrons leaves a gun assembly, the beam is accelerated toward the face of the CRT by an extremely high voltage that may range from 20,000V to 45,000V

10. Select true statements concerning the importance of convergence in RGB monitors by placing an "X" in the appropriate blanks.

______a. With a color signal, each electron beam has to strike the screen at a general location

______b. To help guide the separate beams, there's a mask behind the CRT phosphors, and the mask is much like a pinhole behind each of the three-dot clusters

______c. For a specific color to be seen in a specific location on the CRT, the beams have to converge at the end of the color gun

______d. Since resolution is based on the number of locations per line, the higher the resolution the more locations, and the more locations, the more red, green, and blue dots are required

TEST

11. Complete statements concerning how a CRT yoke works by inserting the word(s) that best completes each statement.

    a. The beam created at the gun and accelerated toward the screen must be moved from ____________ to ____________ in order to paint a picture on the screen

    b. Magnetic fields created in the yoke of the CRT sweep the beam across the screen so the beams can hit specific locations in what is called a ____________ pattern

    c. ____________ patterns may vary from ordinary television sets and microcomputer monitors, but there is an industry attempt to keep the ____________ patterns set to the NTSC standard

12. Complete statements concerning how a standard television scanning pattern works by circling the word(s) or figure(s) that best completes each statement.

    a. The raster is the pattern of lines created on a CRT when there is (**a, no**) video signal

    b. The standard television scanning pattern is a total of (**256, 525**) horizontal scanning lines, in a rectangular frame with a 4 × 3 aspect

    c. When one complete rectangular picture is formed, it's called a scanning frame, and the standard scanning pattern has (**10, 30**) frames per second

    d. Since the brain can barely detect (**10, 30**) frames per second, the scanning pattern fools the brain by breaking the frame into two fields at 60 frames per second

    e. The first field in the frame traces through the entire frame in 1/60 of a second and covers (**128, 262 1/2**) lines with the even lines first

    f. The second field in the frame traces through the entire frame in 1/60 of a second and covers (**128, 262 1/2**) lines with the odd lines first

    g. Interlacing the even/odd parts of the frame give the full (**256, 525**) horizontal scanning lines in the standard scanning pattern

13. Differentiate between monitor control devices by placing an "X" beside the definition of a contrast control.

    _____a. Creates a relative difference in brightness between the background and the characters on the screen

    _____b. Controls the intensity of the beam striking the screen and works like a rheostat on an ordinary light because the higher you turn it, the brighter it gets

TEST

(NOTE: If the following activities have not been accomplished prior to the test, ask your instructor when they should be completed.)

14. Demonstrate the ability to:

    a. Use a CRT display to evaluate monitor problems. (Job Sheet #1)

    b. Discharge high voltage from a CRT and make a sensory check of the monitor. (Job Sheet #2)

    c. Check the power supply and operating voltages on a monitor. (Job Sheet #3)

    d. Troubleshoot monitor picture problems related to voltage. (Job Sheet #4)

    e. Check the sweep signal on a color monitor. (Job Sheet #5)

    f. Troubleshoot RGB and monochrome signals on a computer monitor. (Job Sheet #6)

SERVICING AND REPAIRING COMPUTER MONITORS
UNIT IV

ANSWERS TO TEST

1. a. 3
   b. 5
   c. 1
   d. 6
   e. 4
   f. 2

2. a. 1) Analog
      2) Power supplies, power supplies
   b. High resolution
   c. Color
   d. Oscilloscope

3. a. Immediately behind the screen
   b. Implode
   c. Safety glasses

4. b

5. a. 1) +5V
      2) Analog
   b. 1) Digital
      2) IC's
      3) MOS
      4) Integrate, with

6. b,c,d

7. a. RGB
   b. Sync
   c. Horizontal, vertical
   d. High, horizontal
   e. Video
   f. Guns

8. a,b,c

9. a. 7
   b. 1
   c. 2
   d. 5
   e. 6
   f. 3
   g. 4

ANSWERS TO TEST

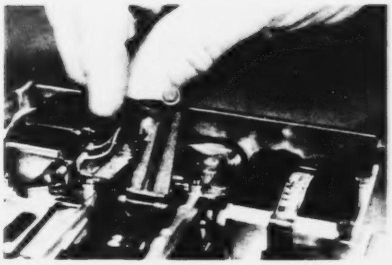
10. b,d

11. a. Place, place
    b. Scanning
    c. Scanning, scanning

12. a. No
    b. 525
    c. 30
    d. 30
    e. 262 $\frac{1}{2}$
    f. 262 $\frac{1}{2}$
    g. 525

13. a

14. Performance competencies evaluated according to written procedures in the job sheets



SERVICING AND REPAIRING FLOPPY DISK DRIVES
UNIT V

UNIT OBJECTIVE

After completion of this unit, the student should be able to discuss the procedures for formatting a 5 1/4" floppy disk and for writing to and reading from a disk. The student should be able to define component functions in disk drive electromechanical and electrical subsystems. The student should also be able to validate a disk drive malfunction, clean and lubricate a drive, adjust speed on a drive, and align a disk drive read/write head. These competencies will be evidenced by correctly performing the procedures outlined in the job sheets and by scoring 85 percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms related to servicing and repairing floppy disk drives with their correct definitions.
2. Complete statements concerning keys to successful floppy disk drive repair.
3. Select true statements concerning disk drive controllers.
4. Complete statements concerning the dynamics of reading from or writing to a floppy disk.
5. Select true statements concerning how a microcomputer uses a program from disk.
6. Complete statements concerning control activities in floppy disk formatting.
7. Arrange in order typical steps in formatting a floppy disk.
8. Select true statements concerning how tracks and sectors are selected.

OBJECTIVE SHEET

9. Match system detectors with their functions.

10. Match electromechanical subsystem components with their functions.

11. Match electrical subsystems with their general functions.

12. Complete statements concerning specific control functions of the electrical subsystems.

13. Complete statements concerning special tools recommended for repairing disk drives.

14. Select true statements concerning cable and connector trouble spots.

15. Select true statements concerning technical and graphic materials required for troubleshooting.

16. Complete a list of cost factors important in disk drive repair.

17. Match typical diagnostic disk tests with their functions.

18. Complete a list of guidelines for troubleshooting faulty disk drives.

19. Demonstrate the ability to:

    a. Validate a floppy disk drive failure. (Job Sheet #1)

    b. Troubleshoot, clean, lubricate, and prepare a floppy disk drive for adjustments. (Job Sheet #2)

    c. Adjust speed and align the head on a floppy disk drive. (Job Sheet #3)

SERVICING AND REPAIRING FLOPPY DISK DRIVES
UNIT V

SUGGESTED ACTIVITIES

A. Provide students with objective sheet.

B. Provide students with information sheet.

C. Make transparencies.

D. Discuss unit and specific objectives.

E. Discuss information sheet.

F. Discuss and demonstrate the procedures outlined in the job sheets.

G. Invite a local or area computer store owner to talk to the class about floppy disk drive repair, the special challenge the field presents to the technician, and problems common to floppy drives.

H. Review "Peripherals" in Unit VII of MAVCC's *Basic Microcomputer Service Technician* for other valuable information about floppy disk drive service.

I. Use the IBM or TRS-80 Computerfacts™ as sources for floppy drive schematics that can be examined and discussed in class.

(NOTE: If you do not have the IBM or TRS-80 Computerfacts™, call MAVCC toll free at 1-800-654-3988 for ordering information and a special educational discount on these valuable materials.)

J. Give test.

CONTENTS OF THIS UNIT

A. Objective sheet

B. Information sheet

C. Transparency masters

    1. TM 1 — Parts of a 5 1/4" Floppy Disk

    2. TM 2 — Inserting a Floppy Disk

    3. TM 3 — Handling a Floppy Disk

    4. TM 4 — 5 1/4" Floppy Disk Drive/Disk Drive Features

CONTENTS OF THIS UNIT

D. Job sheets

  1. Job Sheet #1 — Validate a Floppy Disk Drive Failure

  2. Job Sheet #2 — Troubleshoot, Clean, Lubricate, and Prepare a Floppy Disk Drive for Adjustments

  3. Job Sheet #3 — Adjust Speed and Align the Head on a Floppy Disk Drive

E. Test

F. Answers to test

REFERENCES USED IN DEVELOPING THIS UNIT

A. *SAMS Computerfacts™ CSCS2 COMPUTER: IBM® PC5150.* Indianapolis, IN 46206: Howard W. Sams & Co., Inc., 1985.

B. *SAMS Computerfacts™ CSCS4 COMPUTER: TRS-80® III.* Indianapolis, IN 46206: Howard W. Sams & Co., Inc., 1985.

C. *TRS-80® Model III Technical Reference Manual for Programmers and Technicians.* Fort Worth, TX 76102: Tandy Corporation, 1981.

SERVICING AND REPAIRING FLOPPY DISK DRIVES
UNIT V

INFORMATION SHEET

I. **Terms and definitions**

A. Four-phase signals — Electrical signals with an overall relationship, but developed in such a way that four distinct signals operate at different times so they drive a servo mechanism such as a stepper motor

B. Sector — A section of a floppy disk which designates an area related to the distance from the center of the disk to the outside edge; it is used with track data to pinpoint a location on a disk

C. Servo — Terminology indicating motor control of some sort of heavy task that cannot be accomplished with electronic signals alone

D. Servo board — The control circuitry that develops small electronic signals from IC's into current capable of driving something as heavy as a stepper or drive motor

(NOTE: Electronic signals are usually converted into analog signals, and in this unit, the servo board is referred to by its other name — the analog board.)

E. 00 (zero zero) track — The track on the extreme outside of a floppy disk; it serves as home position for the read/write head and as a reference point for head placement

F. Track — A section of a floppy disk which designates a specific concentric ring that circles the disk; it is used with sector information to pinpoint a location on a disk

II. **Keys to successful floppy disk drive repair**

A. Know the fundamental structure of a 5 ¼" floppy disk (Transparency 1)

B. Insert floppy disks properly and handle floppy disks with care (Transparencies 2 and 3)

C. Be able to relate floppy disk structure to floppy disk drive functions (Transparency 4)

D. Develop the habit of making a backup disk anytime software permits making a backup

(NOTE: Certain diagnostic disks that are copied will indicate the drive is operating properly when it may be out of alignment or require major adjustments; don't waste time backing up a diagnostic disk that clearly indicates it cannot be copied.)

INFORMATION SHEET

E. Learn the relationships of the subsystems in a disk drive:

1. Electromechanical
2. Electrical
    a. Digital
    b. Analog

F. Learn the functional procedures for formatting a disk and for writing to or reading from a disk

G. Use systematic troubleshooting routines to produce cost-effective repairs

III. **Disk drive controllers**

A. Disk drive operations are controlled in a microcomputer system by a disk drive controller section

B. The disk drive controller may be on the main microcomputer board or on a separate disk drive control board

C. Some disk drive control functions are now contained in IC's that are LSI floppy disk formatter/controller chips

(NOTE: These small, plug-in integrated components perform the same control functions which previously demanded fairly large printed circuit cards, and it's another good example of how component evolution is changing the world of microcomputers and peripherals.)

IV. **The dynamics of reading from or writing to a floppy disk**

A. In order to read from or write to a floppy, the microcomputer must know:

1. That the disk drive is turned ON
2. That a floppy disk has been inserted and is in place
3. That the disk drive door is closed so that the disk hub clamp is properly clamped in order to rotate the disk inside its protective cover

B. The microcomputer must also determine the location of information on the floppy disk, and this is done by:

1. Passing a small hole in the mylar disk past a specific point each time the disk rotates
2. There is a photosensor/light in the disk drive that penetrates the hole in the disk with light each time the disk rotates

INFORMATION SHEET

3. The photosensor activity creates a signal to tell the system that the disk has made one complete revolution

4. The time space between the photosensor signals also helps find sector and track locations

C. The microcomputer must also know the location of the read/write head in order to:

1. Determine the in and out location of information on the disk, or the sector and track locations of information

2. Determine sector location by using signals generated as the hole in the disk passes over the photosensor/light combination

3. Determine track location by using information from the magnetic head that slides in and out across the disk and is traceable to 00 (zero-zero) track information

D. The microcomputer must also determine that the head has been properly placed down or "loaded" onto the disk so that it can read/write or erase

V. **How a microcomputer system uses a program from a disk**

A. The microcomputer is turned ON

B. The microcomputer boots up with ROM

C. As soon as the system boots up, the microcomputer must continue to operate in ROM or transfer control to the DOS program on disk

D. If control is transferred to the DOS program, the disk drive must be activated and that part of the DOS program necessary for full control of the system must be transferred into ROM

(NOTE: It may sound like the old chicken/egg argument, but the system cannot transfer information from the disk in order to permit disk drive control without having in ROM the initial control procedures for activating and running the disk drive.)

E. Once a DOS program is installed in RAM, programs stored on the disk are fully accessible within the limits of the program

VI. **Control activities in floppy disk formatting**

A. The floppy disk must be inserted in the drive in the proper orientation so that the write-protect notch can be sensed by either a microswitch or a photosensor

B. Improper disk orientation also stops the photosensor/light timing functions as the hole in the disk passes over it to determine RPM and sector locations

INFORMATION SHEET

C. After a disk is properly inserted, the door/latch must be closed so that the drive motor hub clamp will be centered and pulled down to firmly clamp the disk to the spindle motor

D. Closing the drive door may also activate a switch that starts the spindle motor, but in some drives, the spindle is turning before the door is closed

E. Closing of the drive door sends a signal back to the system to indicate that a disk has been inserted, that the door is closed, and that the disk is properly in place

F. Since a door can be closed without inserting a disk, there is usually a mechanism that detects the presence or lack of a disk

G. The formatting control functions serve to let the system know:

1. That a disk has been properly inserted
2. That the disk is properly clamped and rotating
3. Whether or not the disk is write-protected
4. That the photosensor/light is in proper relation to the spinning hole in the disk and that RPM and sector information are correct

VII. **Typical steps in formatting a floppy disk**

A. Signals to indicate proper disk insertion are sent from the disk drive to the disk controller via control lines

B. The disk controller coordinates the disk drive information with information from the DOS and its appropriate formatting utility

C. The formatting utility will:

1. Read the disk to determine if there is information stored on the disk
2. Inform the user by way of a CRT readout that the disk does contain information that will be destroyed during the formatting process
3. Upon user commands, erase existing information on a disk so that it will not interfere with the new storage format
4. Upon user command, overlay a magnetic storage format on the blank disk

D. Once the format has been overlayed on the blank disk, the formatted disk will accept the application selected by the user

INFORMATION SHEET

VIII. How tracks and sectors are selected

A. To read from or write to a disk, specific tracks and sectors must be located, and finding these locations is a function of timing

(NOTE: There are a number of sophisticated analog and digital signal exchanges in a read/write procedure, and these will be discussed later.)

B. The rotary drive motor that turns the spindle runs at a constant speed, usually 300 RPM

C. After the disk is clamped to the spindle, the disk rotates under the read/write head as a sensor picks up the passing of the hole in the disk

D. The time frame space from sensor activity until the head arrives at the proper sector location is a timing function

E. After sector location, the read/write head must be moved from its present location, which may or may not be at track 00, in or out to the proper track location

F. Locating the proper track also requires that the read/write head be pulled down onto the disk, and this is accomplished with a head loading signal

G. To read data once sector and track are located, the electronic system will be turned into a magnetic pickup similar to the pickup used with a tape recorder

H. To write data once sector and track are located, the electronic system will send to the head a signal that creates a magnetic field

I. The oxide surface of the disk is magnetized in one direction or the other with respect to polarity in order to create binary 1's and 0's on the oxide surface of the disk

J. Each track/sector location is wide enough to accommodate a fairly large number of binary bits at a given density as the head moves across the sector

K. Data is recorded across the sector because the sector location is a continuous activity that can have a variable number of locations

L. Track location is a discrete function tied into the construction of the stepper-type head motor which permits any one of a given number of positions, but is not continuous

IX. System detectors and their functions

A. Write protect notch detector — This microswitch or photosensor/lamp combination senses the presence or absence of a tab over the write protect notch

(NOTE: This actually works like an interrupt on a microcomputer to alert a user that the covered tab indicates there may be important information on the disk and to check it out before proceeding.)

INFORMATION SHEET

B. Track 00 detector — Usually a photosensor that is connected to the control system in such a way that it can inform the system if the head is or is not at track 00 because the track 00 reference is used for positioning the head correctly in other track locations

(NOTE: There is also a track stopper associated with this mechanism, and this device keeps the head from going past track 00 so that when it steps out it will not step out from some position other than track 00.)

C. Index hole detector — This photosensor/lamp combination sends out a signal each time the hole in the disk passes over it, and this speed and position information is a vital timing function

X. **Electromechanical subsystem components and their functions**

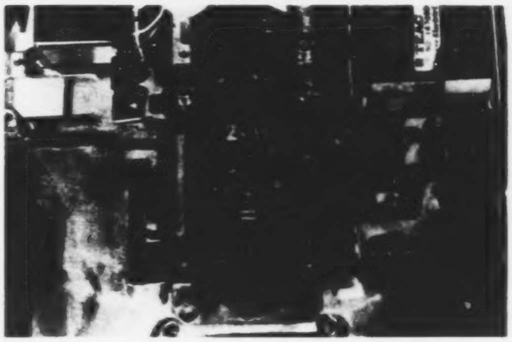
A. Frame — Provides a rugged case to house the disk drive so that it will protect the drive from movement or warping that could put the head out of alignment

B. Door/latch mechanism — Causes the spindle to move when it is closed, centers the disk, and clamps the disk to maintain stability between the spindle and motor drive hub as the disk rotates

C. Rotary drive motor — Usually a DC brushless motor designed to run at a fixed speed (usually 300 RPM) for a long operational life

D. Magnetic head — A miniaturized version of a tape recorder head complete with an erase facility so it can read, write, or erase, and very light weight so it can move rapidly on the head carriage (Figure 1)

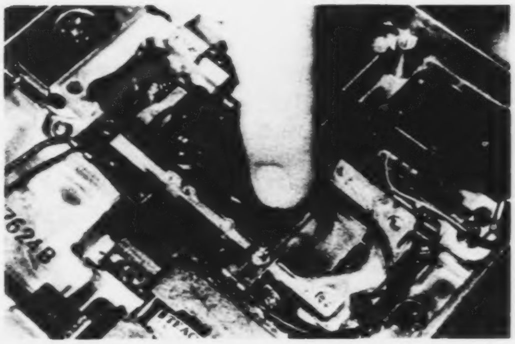
FIGURE 1



INFORMATION SHEET

E. Head carriage — The housing for the magnetic head, designed to move quickly along rails or tracks to position the head in a track location in response to a signal sent to a stepper motor (Figure 2)

FIGURE 2



F. Head load mechanism — A spring loaded lifter mechanism controlled by a solenoid that caused the head to be pressed (loaded) against the oxide on the disk only when the disk drive is turned ON

G. Head position seek mechanism — A mechanical device tied in with the stepper motor that moves the carriage to designated track positions

(NOTE: In some disk drives, there is a band that connects the head to the stepper motor, and if the band is damaged or broken, the system will have trouble seeking or will not seek proper track locations; here again is a good example of how an electromechanical problem can be quickly localized.)

XI. **Electrical subsystems and their general functions**

A. Digital signals — These are the reference signals for the binary 1's and 0's when writing to or reading from a disk

B. Analog signals — These are the control signals for the DC brushless motors and the stepper motors used in disk drives, and they are designed to be directly interfaced with digital components

C. Passive read circuitry — Employs a highly sensitive amplifier that turns the read/write head into a sensitive detector that picks up the magnetically stored binary 1's and 0's and sends them along with synchronized timing information to the microcomputer

INFORMATION SHEET

D. Write circuitry — Takes information from the microcomputer, synchronizes it with disk and head location, then generates magnetic signals across the head so that the oxide surface of the disk is polarized directionally as binary 1's or 0's

(NOTE: The write circuitry is tied into the write protect notch detector so that current will not enter the head when there is a tab over the write protect notch.)

E. Control circuitry — Synchronizes and logically manages all read/write activities and reads signals from the detection devices

XII. **Specific control functions of the electrical subsystems**

A. Locating sectors by the position of the disk in relation to the index hole

B. Locating tracks by the position of the head in relation to 00 track

C. Activating the sense amplifiers for reading from a disk

D. Activating the high current drivers required to produce the current for polarizing the oxide coating on the disk when writing to the disk

E. Reading signals from the detection devices

F. Providing DC control for the brushless DC motor that turns the spindle and rotates the disk

G. Providing four-phase control to operate the stepper motor

XIII. **Special tools recommended for repairing disk drives**

A. A small battery operated DC vacuum cleaner is recommended because an AC vacuum cleaner produces a magnetic field that could erase memory

B. Canned compressed air or gas is recommended for cleaning because it will remove microscopic particles of contaminants without scratching sensitive head components or leaving a residue

(NOTE: Micro Duster from TEXWIPE or 70 PSI® from Chemtronics are good sources of compressed cleaning gasses in spray-type aerosol cans.)

C. Clear isopropol alcohol, not methyl alcohol, is recommended for cleaning areas that cannot be brushed or cleaned with air

D. Lint-free cleaning swabs or cleaning sticks with urethane foam tips are recommended cleaning tools for use with isopropol alcohol

(**CAUTION:** Cotton-tipped cleaning tips should not be used around disk drives and printers because they leave lint that is hard to remove and potentially damaging to certain components.)

INFORMATION SHEET

E. Precision oilers are recommended for disk drive spindles and other areas where excess oil would be difficult to remove or where excess oil could damage a nearby component

F. High quality machine oil may be used for general lubrication, but teflon-based oil is recommended for certain applications

(**CAUTION:** Do not use WD-40 or similar lubricants on disk drive or printer components because they dry too quickly, and in all cases, use the lubricant and quantity specified in OEM instructions.)

G. An aerosol spray contact cleaner is recommended for cable connectors and other contacts

(**CAUTION:** Do not use an eraser to clean contacts of any kind because it reduces critical coating thicknesses and accelerates failure.)

XIV. Cable and connector trouble spots

A. In some cases, the 34-pin disk control connector can be put on upside down, and care should be taken when handling this connector

B. The connectors that attach the printed circuit card(s) to the drive are delicate and must be handled with special care

C. The connectors that attach the printed circuit card(s) to the drive must be replaced exactly and this may require sketching their arrangement before removal

D. The cable from the disk controller out to the drive has several connectors on it, and the last connector on the cable is the terminator and requires special attention

E. The terminator terminates the impedance of the drive and must be reinstalled in its original position

F. The terminator looks like an IC and actually plugs into an IC socket and should be easy to locate by referencing a proper schematic

(NOTE: If the drives are inadvertently switched, the terminator can be removed with an IC extractor and placed in the correct drive.)

XV. Technical and graphic materials required for troubleshooting

A. When original technical information is available from a disk drive or printer manufacturer, it should be referenced and followed carefully in all troubleshooting

B. OEM schematics should always be referenced for troubleshooting, adjustments, and repairs, and if OEM schematics are not available, a source such as Computerfacts™ should be used

INFORMATION SHEET

C. A good technician should always keep notes of problems peculiar to specific disk drives and the troubleshooting techniques that are most suitable for the problems

D. When an error is discovered in technical information, it should be corrected so the error will not contribute to future confusion or costly delay

XVI. **Cost factors important in disk drive repair**

A. As the disk drive industry has improved manufacturing techniques, the cost of quality replacement disk drives has continued to drop

B. Because of available low-cost replacements, repairing disk drives with certain problems can easily cost more than installation of a replacement drive

C. Disk drive problems that would not be cost-effective to repair generally include:

1. A faulty drive motor

   (NOTE: If a known good drive motor from another disk drive is available, replacement is recommended, but otherwise, a replacement drive will be the least expensive procedure.)

2. A faulty read/write head

   (NOTE: Here, again, a good head from another drive may solve the problem, but otherwise, replace the entire disk drive.)

3. Faulty digital or analog boards

4. A faulty stepper motor

5. Obvious situations that indicate combinations of malfunctions that would take extensive time to isolate and correct

XVII. **Typical diagnostic disk tests and their functions**

A. Radial alignment test — Checks to see if the read/write head is centered directly over a given track location

B. Disk speed test — Checks to see if the drive rotates at specified RPM

C. Disk clamping test — Checks to see if the system will hold a floppy disk firmly and accurately in place

D. Write/read test — Checks to see if the drive will accurately record (write) and then play back (read) a random set of numbers

(NOTE: Most of the tests give ratings good, fair, or poor, but the read/write test is a simple pass/fail test.)

INFORMATION SHEET

XVIII. Guidelines for troubleshooting faulty disk drives

A. Validate the malfunction

(NOTE: This is to assure that in-depth troubleshooting time will not be wasted on a drive that doesn't really need it, and Job Sheet #1 outlines the procedure.)

B. Check all cables and connectors that can be checked without disassembly

C. Try to boot the system with a DOS disk

D. Try to run a diagnostic disk

E. Begin in-depth troubleshooting only if the DOS or the diagnostic will not run

F. Start in-depth troubleshooting by checking for +5V and +12V on the power connector to the drive

G. Clean the drive

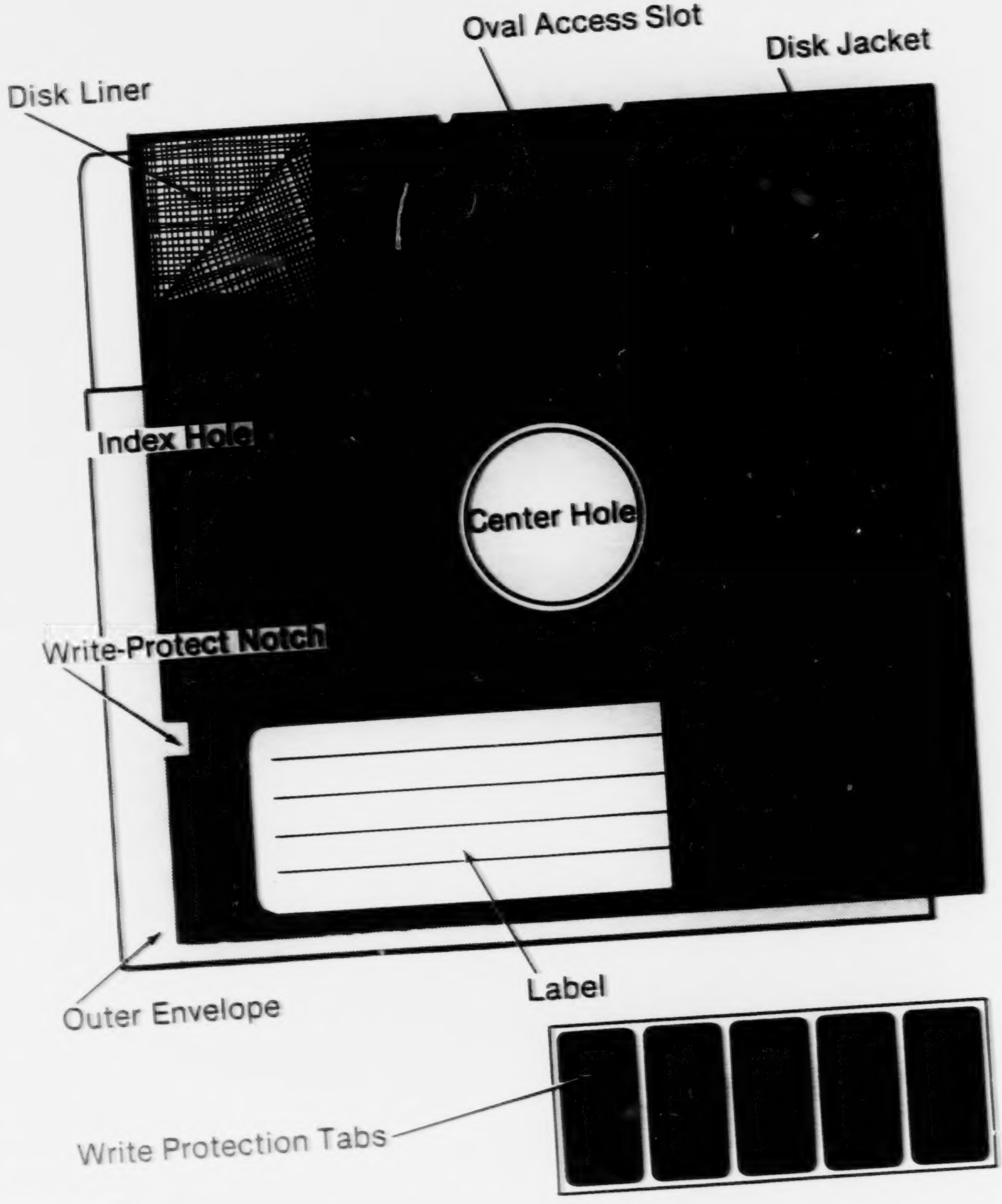
H. Lubricate the drive

I. Make timing adjustments

J. Make head alignment adjustments

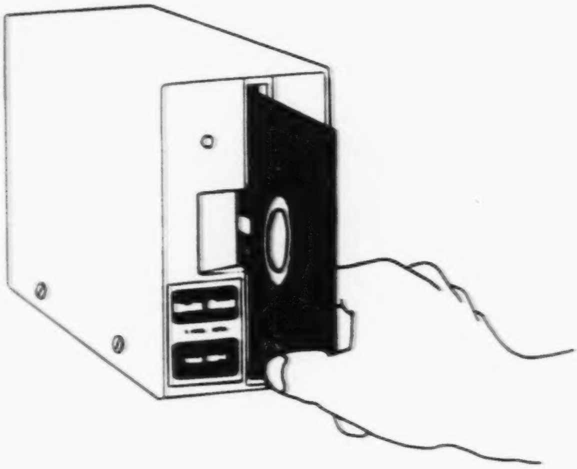
K. Make a cost-effective final disposition

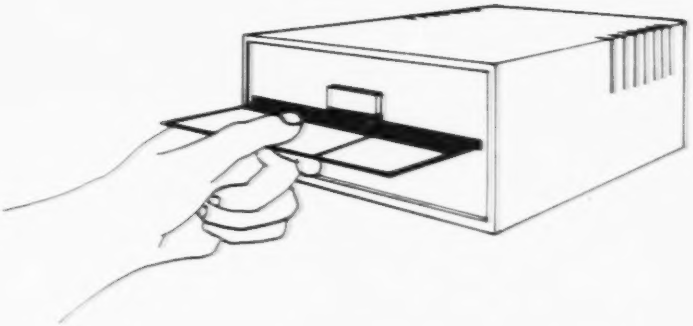
Parts of a 5 1/4" Floppy Disk

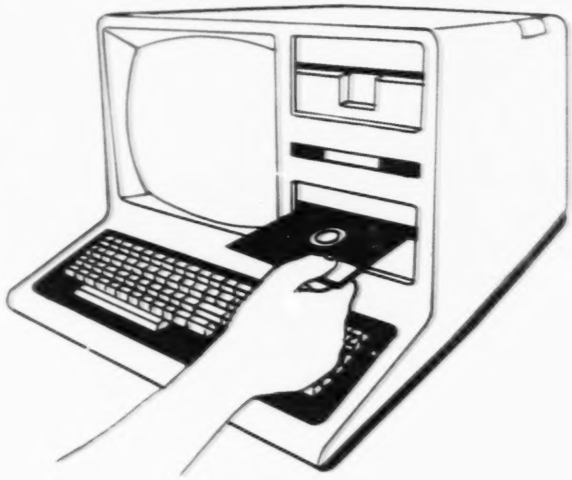

Oval Access Slot
Disk Jacket
Disk Liner
Index Hole
Center Hole
Write-Protect Notch
Label
Outer Envelope
Write Protection Tabs

TM 1

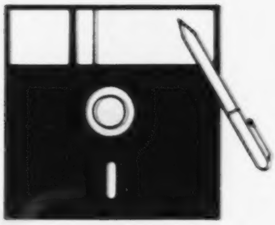
Inserting a Floppy Disk



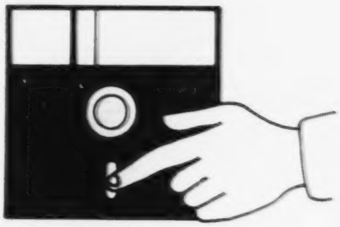




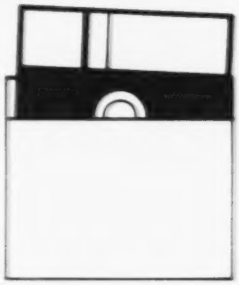
Handling a Floppy Disk



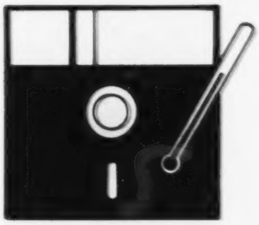
Use only felt tip pen on jacket



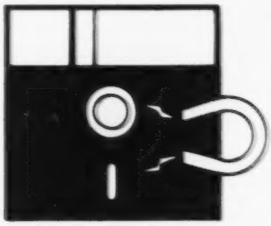
Never touch disk



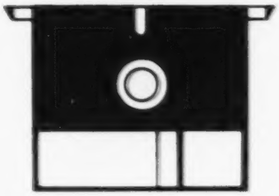
Protect in envelope



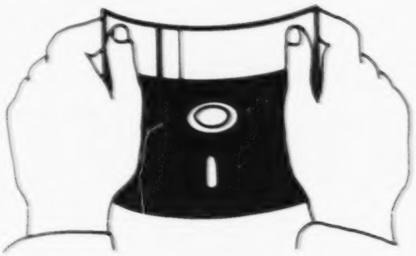
Maintain temperature of 50°F to 125°F



Never expose to magnetic field

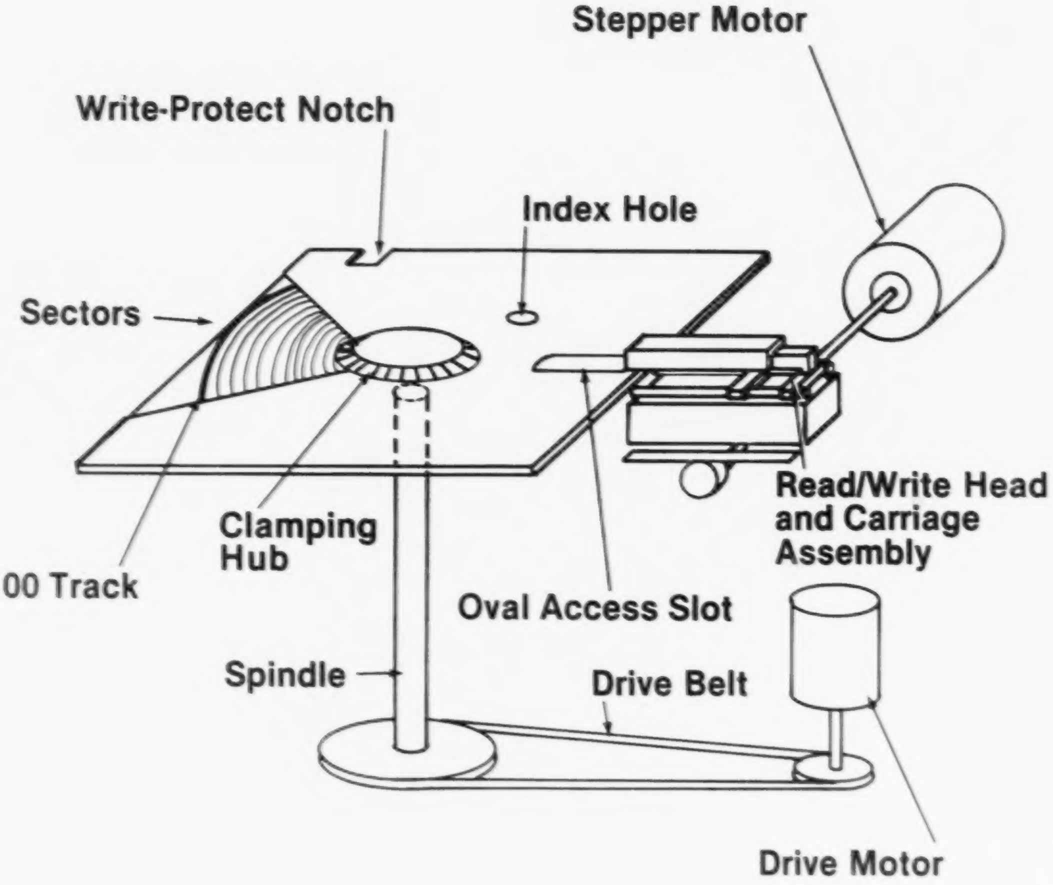


Insert carefully



Do not bend or fold

5 1/4" Floppy Disk/Disk Drive Features


Stepper Motor
Write-Protect Notch
Index Hole
Sectors
Read/Write Head and Carriage Assembly
Clamping Hub
00 Track
Oval Access Slot
Spindle
Drive Belt
Drive Motor

SERVICING AND REPAIRING FLOPPY DISK DRIVES
UNIT V

JOB SHEET #1 — VALIDATE A FLOPPY DISK DRIVE FAILURE

A. Tools and equipment

1. Malfunctioning disk drive
2. Microcomputer system as selected by instructor
3. DOS for microcomputer system
4. Maintenance or diagnostic disk as required
5. Standard hand tools
6. Small flashlight
7. Pencil and paper

B. Procedure

1. Sign on your troubleshooting log that accompanies this job sheet and save the log for use with other job sheets in this unit
2. Configure the microcomputer system, including disk drive, as it was when the failure occurred

   (NOTE: This procedure should always precede troubleshooting activities because the reported failure may have been in error to begin with or the failure may be as simple as a bad connection that can be quickly corrected.)
3. Check all cables and connectors in the system that you can check without disassembly
4. Plug the microcomputer system in and turn it ON
5. Insert the DOS in the disk drive
   a. If the DOS will boot the system up, run a program to determine if the faulty disk drive diagnosis was made in error
   b. If the DOS will boot the system up, it is still possible the disk drive may have been operated in an improper environment
   c. If a visual inspection of the drive with a small flashlight indicates a dirty drive, then go to Job Sheet #2 and complete the procedures for cleaning

JOB SHEET #1

   d. If the DOS will not boot the system up, then try to run a diagnostic disk on the system

6. Run the diagnostic disk as far as it will go

   a. If the diagnostic disk will not run at all, then the reported disk drive failure is valid

   b. If the diagnostic disk will run, makes notes of how far it will run and the problem(s) indicated

      (NOTE: Most diagnostic disks will drive a system up to the point of failure.)

   c. If the diagnostic disk indicates an alignment problem, insert an alignment disk

7. Run the alignment disk and make corrections as indicated

   (NOTE: This may require reviewing information in Routine #2 in Job Sheet #3.)

8. Remove the alignment disk and run the diagnostic disk again

   a. If the diagnostic runs all the way through and indicates no further problems, the alignment routine probably solved the problem

   b. If the diagnostic will not continue to run, the alignment did not solve the problem, and the drive will require in-depth troubleshooting

9. Remove the diagnostic disk and place all disks back in their protective jackets

10. Make notes of your findings

    ☐ Have your instructor check your work

11. Unplug the microcomputer to prepare the system for in-depth disk drive troubleshooting

12. Sign off your troubleshooting log

JOB SHEET #1

Troubleshooting and Repair Log

Customer's Name ______________________ Invoice ____________

Date ____________ Equipment and Serial # ____________________

Complaint ____

____

Technician's Name & ID #	Date	Time On	Time Off	Work Performed	Replacement Parts Used & Inventory #

SERVICING AND REPAIRING FLOPPY DISK DRIVES
UNIT V

JOB SHEET #2 — TROUBLESHOOT, CLEAN, LUBRICATE, AND PREPARE A FLOPPY DISK DRIVE FOR ADJUSTMENTS

A. Tools and equipment

1. Microcomputer system as selected by instructor
2. Floppy disk drive as selected by instructor
3. DOS, diagnostic, and alignment disks as required
4. Standard hand tools
5. DVOM
6. Small cleaning brushes
7. Small battery operating vacuum
8. Precision oiler/teflon-based lubricant
9. Technical guide or Computerfacts™
10. Replacement pad (for single-headed drive)

B. Routine #1 — Prepare the drive for troubleshooting

1. Sign on your troubleshooting log from Job Sheet #1
2. Validate the disk drive malfunction as previously outlined
3. Remove the microcomputer cover (on an integrated system) to expose the disk drive(s)
4. Check the technical guide for disk drive removal instructions
5. Disconnect the cable that runs from the controller card to the disk drive and use the DVOM to make sure +5V and +12V voltages are available

   (**CAUTION:** The 34-pin control connector can sometimes be replaced upside down, so note how it comes off so you can reinstall it properly, and also check the terminator location.)

JOB SHEET #2

6. Disconnect the 4-pin connector

   (NOTE: With few exceptions, the controller connector and the 4-pin connector are the only ones that go to the disk drive.)

7. Remove the screws that secure the disk drive to the frame of the microcomputer and place them where they will be easy to find for replacement

8. Remove the disk drive through the front or through the rear of the microcomputer as indicated in the technical literature, and place it on a clean open area of the workbench

   ☐ Have your instructor check your work

C. Routine #2 — Remove and clean printed circuit cards

1. Make a quick sensory inspection of the PC cards

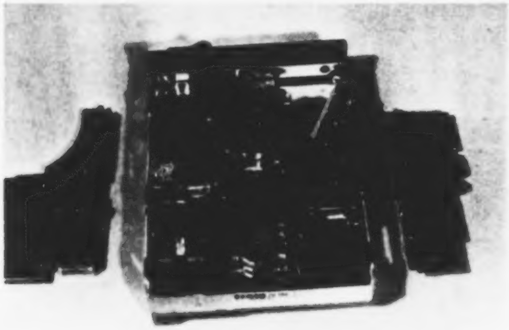
2. Remove the screws (usually Phillips head) that secure the printed circuit cards to the top of the disk drive

3. Observe carefully the connectors that attach the PC cards to the rest of the drive and note how the connectors are attached

   (**CAUTION:** Note means to write it down or draw a sketch because it is vital that these connectors be properly replaced.)

4. Remove the connectors with care and set the PC cards aside for cleaning (Figure 1)

   FIGURE 1



5. Clean the PC cards with a soft brush, or if they seem unusually dirty, use a non-static spray cleaner

   (NOTE: It must be a cleaner designed especially for cleaning PC cards and board.)

JOB SHEET #2

6. Set the PC cards aside and make a final visual inspection for any burned or damaged components

   ☐ Have your instructor check your work

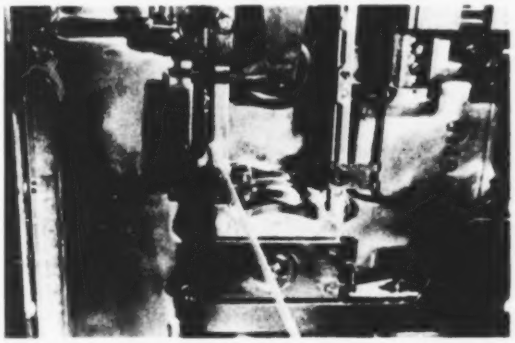
D. Routine #3 — Clean mechanical parts of the disk drive

1. Use a vacuum to pick up loose dirt and other matter

2. Use a can of compressed cleaning gas to go over all mechanical parts of the drive after the drive has been vacuumed (Figure 2)

   (**CAUTION:** Position the spray can so that the jet of compressed gas will force dirt particles away from, not into, critical areas of the drive.)

   FIGURE 2



3. Go over all the mechanical parts that have been cleaned with compressed gas with a lint-free swab lightly wet with isopropol alcohol

   (NOTE: Be sure this includes the rails that the carriage moves on because they can attract a great deal of dirt.)

4. Get a fresh lint-free swab, wet it lightly with isopropol alcohol, and clean the head with the following procedure:

   a. Start on the inside area of the head with a slight circular motion

   b. Work your way to the outside of the head slowly, and don't be afraid to exert some pressure because it's difficult to get oxide residue off a head

   c. If the swab becomes overladen with oxide residue, throw it away and use a new one

   d. Go over the head again with another swab after the first complete cleaning is completed

JOB SHEET #2

e. Repeat the procedure as needed until you can rub a cleaning swab on any point of the head and it comes out clean

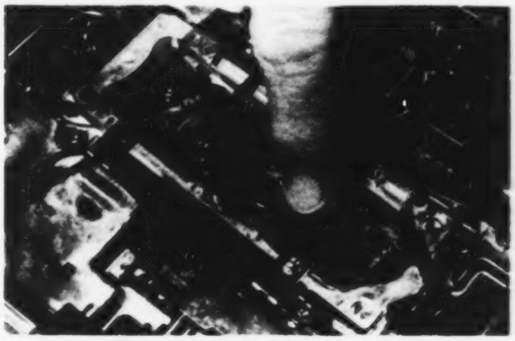
(NOTE: The secret to using alcohol as a cleaner or in using the head-cleaning liquid is to use the alcohol or head cleaner sparingly.)

☐ Have your instructor check your work

E. Routine #4 — Check the drive for mechanical problems

1. Inspect the bearing surfaces on the carriage rails and slides
2. Check the connection between the stepper motor and the slides, and this may be a belt or a thin metal band
3. Move the head carriage along the rails while checking to see that the stepper motor is free (Figure 3)

FIGURE 3



4. Turn the disk drive motor with your finger to make sure it is free, and if it is not a direct-drive design, check the drive motor and spindle
5. Check the drive belt too if it is not a direct-drive system
6. Replace the belt if required, but be sure to clean the belt drive surfaces with alcohol and a lint-free swab because residue from the old belt will probably remain

(NOTE: Do not touch the belt itself with alcohol.)

7. Make a final visual inspection to assure that all possibilities for mechanical problems have been examined

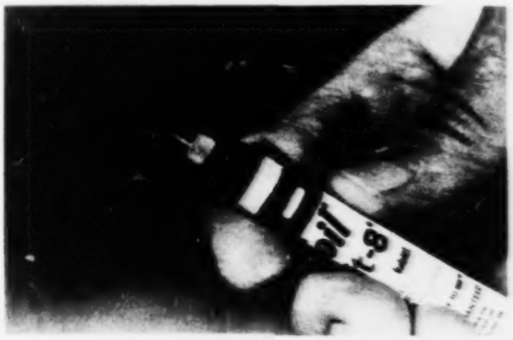
☐ Have your instructor check your work

JOB SHEET #2

F. Routine #5 — Lubricate all critical bearing points

1. Use a precision oiler with teflon-based oil for all lubrication because it is the best way to avoid problems with excess oil (Figure 4)

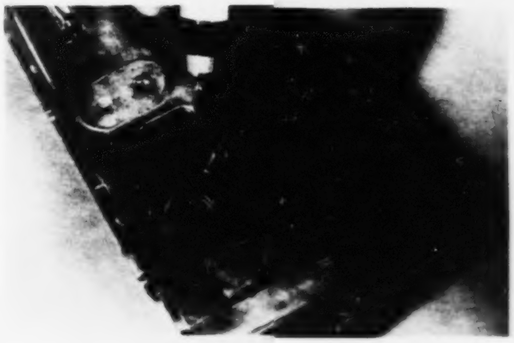
FIGURE 4



2. Hold the drive so that oil will drip naturally into one end of the motor bearing and apply two small drops of oil

3. Allow the oil time to work itself into the bearing, then turn the drive so that the other motor bearing can be lubricated in the same way (Figure 5)

FIGURE 5



4. Allow the oil time to work itself into the bearing, and it's a good idea to move the head carefully back and forth so the motor will move enough to distribute oil completely through the bearing

JOB SHEET #2

5. Repeat the same lubrication procedure for the stepper motor bearing

6. Oil the spindle bearing in the same manner on systems has a drive motor separate from the spindle

7. Clean off any excess oil with a lint-free swab wet lightly with alcohol

8. Lubricate the carriage rails with the following procedure:

   a. Take a lint-free swab and wet it with a small amount of teflon-based oil

   b. Work the swab up and down the rail until you reach the head carriage

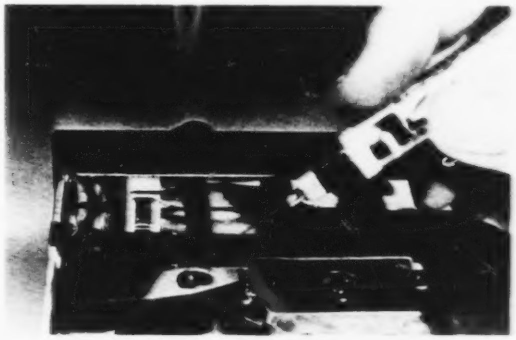
   c. Move the head carriage to the other end of the rail and complete lubrication of the rail

   (**CAUTION:** Do not get oil on the head carriage.)

9. Check the head carefully to make sure it has absolutely no oil in it, and as a safety procedure, take a light alcohol-wet swab and clean the head yet another time

10. Lubricate the door/latch mechanism (Figure 6)

FIGURE 6



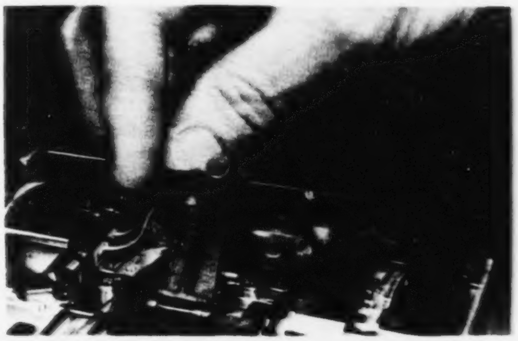
11. Take time at this point to replace the pad opposite the head if it is a single sided system

JOB SHEET #2

12. Snap the old pad out and snap the new pad in (Figure 7)

    (NOTE: Pads do collect oxide residue, and since they are inexpensive and easy to replace, always put a new pad in.)

    FIGURE 7

    ☐ Have your instructor check your work

G. Routine #6 — Make a final inspection and reassemble the drive

1. Make a final sensory inspection to assure that mechanical parts are okay and that lubrication has been properly applied with no excess oil visible at any point on the drive

2. Replace the PC cards on the drive and be sure you get the connectors back in place properly

   (NOTE: You should have made a sketch of connector placement back in Routine #2, and this would be a good time to use that sketch.)

3. Replace the PC cards and replace the drive in the system or install an extender cable to prepare the drive for adjustment procedures

   (NOTE: An extender cable is mandatory for a dual drive system because the lower drive cannot be reached for adjustment once it has been replaced in the system.)

4. Sign off your troubleshooting log

   ☐ Have your instructor check your work

5. Clean up area and return tools and equipment to proper storage, or prepare for next job sheet as directed by your instructor

SERVICING AND REPAIRING FLOPPY DISK DRIVES
UNIT V

JOB SHEET #3 — ADJUST SPEED AND ALIGN THE HEAD ON A FLOPPY DISK DRIVE

A. Tools and equipment

1. Microcomputer system as selected by instructor
2. Floppy disk drive as selected by instructor
3. DOS, diagnostic, and alignment disks
4. Standard hand tools
5. Oscilloscope
6. Technical guide or Computerfacts™
7. Replacement lights and detectors as required

B. Routine #1 — Check disk drive speed

1. Sign on your troubleshooting log from Job Sheet #1
2. Complete the faulty drive validation procedures and the cleaning and lubricating procedures outlined in Job Sheet #1 and Job Sheet #2
3. Check to make sure the disk drive(s) is properly reinstalled in the system or that the drive is properly set up for checking with an extender cable
4. Plug the microcomputer in and turn it ON
5. Insert the selected diagnostic disk
6. Run each drive check as indicated on the monitor screen
7. Run the diagnostic through until it presents the speed check
8. Complete the speed check as indicated on the screen, and use the following procedures as appropriate:

   (NOTE: The procedure for adjusting disk drive speed with a strobe light is outlined in the "Peripherals" unit of MAVCC's *Basic Microcomputer Service Technician.*)

   a. Check the technical guide to determine the location of the potentiometer for speed adjustment

JOB SHEET #3

   b. If there is a separate analog board on the drive, look for the potentiometer there

   c. Turn the potentiometer screw as technical information directs

   d. Watch the monitor carefully to make sure that your adjustment is in the right direction

   e. The monitor should display a scale that indicates whether the speed is too fast or too slow, and usually, the center of that scale will indicate the correct speed for the drive

   f. In all cases, make the potentiometer adjustment so that the monitor reflects the correct reading

   g. If the speed cannot be adjusted, move on to step 9, and if the speed will properly adjust, move on to step 13

9. Turn the microcomputer OFF, unplug the system, and remove the disk drive

10. Remove the PC cards on the drive so that you can check the drive motor, spindle, bearing, and the connecting belt

11. Replace the drive belt, if required

12. Replace the drive motor, if required but only under the following circumstances:

   a. If another known good drive motor is readily available from another system, remove the old motor and put the replacement motor in the drive

   b. If another motor is not readily available, it is more cost effective to replace the entire disk drive, and your troubleshooting should end here to avoid further unnecessary cost to the customer

13. Check to make certain speed adjustment is okay or that parts that can be replaced have been properly replaced

   ☐ Have your instructor check your work

C. Routine #2 — Perform a head alignment test

1. Run the diagnostic to the point that it indicates the head alignment test

2. Read the technical literature to doublecheck your procedure

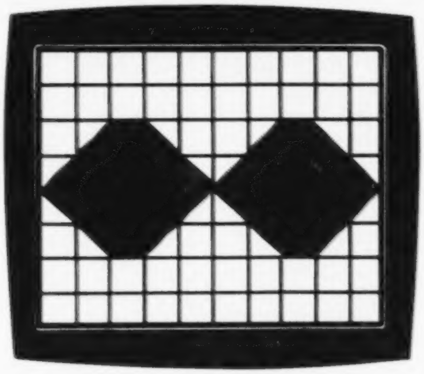
3. Utilize options as required to run the alignment test

   a. In some cases, the procedure calls for the use of an oscilloscope and a test that produces a cat's eye pattern

JOB SHEET #3

   b. If the procedure uses the cat's eye adjustment, hook up the oscilloscope and make adjustments as indicated (Figure 1)

FIGURE 1



   c. The cat's eye adjustment is usually made by balancing both sides of the display so that the cat's eyes are the same size, but the routine varies with disk drive brands, so follow instructions from the alignment disk carefully

4. Complete the alignment check and continue as required:
   a. If alignment is correct, the drive can be placed back in the system
   b. If alignment cannot be made, the read/write head needs to be replaced
   c. Replace the read/write head only if there is a known good head readily available from another disk drive
   d. If another head is not readily available, it is more cost effective to replace the entire disk drive, and your troubleshooting should end here to avoid further unnecessary cost to the customer

D. Routine #3 — Check and replace lights and detectors

1. Replace the load light if the disk drive is operating properly but the LED does not come on when the drive is running
2. Disassemble the drive as needed to reach the load light, and this usually means the PC board will have to be removed
3. Replace the write enable notch microswitch or photosensor/lamp combination if everything else seems to be okay but there is no capability to write to the disk
4. Replace the 00 track detector if everything else seems to be okay but the head will not step to the proper track

JOB SHEET #3

5. Replace the index hole detector if the drive displays problems with locating the correct sector

   (NOTE: All system detectors are inexpensive and easy to replace so there is no reason to leave one in if there is any indication that it is not working.)

   ☐ Have your instructor check your work

E. Routine #4 — Make a final disposition after troubleshooting

1. Review all cleaning and adjustment activities to make sure they have been properly executed

2. Check all cables and connections a final time

   (NOTE: The disk control connector is a 34-pin connector that can, in some cases, be put in upside down, and it's always a good idea to double check it, as well as the terminator.)

3. Note on your troubleshooting log the nature of the work required to service and restore the drive to proper working order

   a. Indicate the time spent on service and repairs

   b. Indicate what components, if any, were replaced

   c. Write a note for the customer if improper use or environmental problems need to be corrected to avoid further problems

4. Note on your troubleshooting log the nature of the problem that makes repairing the drive more expensive than replacing the drive

   a. If the drive motor is bad and there is no ready replacement, it is more cost effective to replace the entire drive

   b. If the stepper motor is bad and there is no ready replacement, it is more cost effective to replace the entire drive

      (NOTE: Replacing a drive motor is a rather simple procedure if a replacement is available, but replacing a stepper motor requires critical adjustments that cannot be made without the proper technical materials, so bad stepper motors usually mean replacing a drive.)

   c. If the head and carriage assembly are bad and there is no ready replacement, it is more cost effective to replace the entire drive

   d. If the electronics on either the digital or analog control boards is bad, it is more cost effective to replace the entire drive

JOB SHEET #3

☐ Have your instructor check your work

5. Unplug all equipment, sign off your troubleshooting log, and save the old disk drive for parts if it should have to be replaced

6. Clean up area and return tools and equipment to proper storage

SERVICING AND REPAIRING FLOPPY DISK DRIVES
UNIT V

NAME ________________________

TEST

1. Match the terms on the right with their correct definitions.

______a. Electrical signals with an overall relationship, but developed in such a way that four distinct signals operate at different times so they drive a servo mechanism such as a stepper motor

______b. A section of a floppy disk which designates an area related to the distance from the center of the disk to the outside edge; it is used with track data to pinpoint a location on a disk

______c. Terminology indicating motor control of some sort of heavy task that cannot be accomplished with electronic signals alone

______d. The control circuitry that develops small electronic signals from IC's into current capable of driving something as heavy as a stepper or drive motor

______e. The track on the extreme outside of a floppy disk; it serves as home position for the read/write head and as a reference point for head placement

______f. A section of a floppy disk which designates a specific concentric ring that circles the disk; it is used with sector information to pinpoint a location on a disk

1. 00 track
2. Servo
3. Four-phase signals
4. Track
5. Sector
6. Servo board

TEST

2. Complete statements concerning keys to successful floppy disk drive repair by inserting the word(s) that best completes each statement.

   a. Know the fundamental ____________ of a 5 ¼" floppy disk

   b. ____________ floppy disks properly and ____________ floppy disks with care

   c. Be able to relate floppy disk ____________ to floppy disk drive ____________

   d. Develop the habit of making a ____________ disk anytime software permits making a ____________

   e. Learn the relationships of the ____________ in a disk drive:

      1) Electromechanical

      2) Electrical

         a) Digital

         b) Analog

   f. Learn the functional procedures for ____________ a disk and for ____________ ____________ or ____________ ____________ a disk

   g. Use ____________ troubleshooting routines to produce ____________ ____________ repairs

3. Select true statements concerning disk drive controllers by placing an "X" in the appropriate blanks.

   _____a. Disk drive operations are controlled in a microcomputer system by a disk drive controller section

   _____b. The disk drive controller is always on the main microcomputer board

   _____c. Some disk drive control functions are now contained in IC's that are LSI floppy disk formatter/controller chips

4. Complete statements concerning the dynamics of reading from or writing to a floppy disk by inserting the word(s) that best completes each statement.

   a. In order to read from or write to a floppy, the microcomputer must know:

      1) That the disk drive is turned ____________

      2) That a floppy disk has been ____________ and is in place

      3) That the disk drive door is ____________ so that the disk hub clamp is properly clamped in order to ____________ the disk inside its protective cover

TEST

b. The microcomputer must also determine the location of information on the floppy disk, and this is done by:

   1) Passing a small hole in the mylar disk past a ____________ point each time the disk rotates

   2) There is a photosensor/light in the disk drive that ____________ the hole in the disk with light each time the disk rotates

   3) The photosensor activity creates a ____________ to tell the system that the disk has made one complete revolution

   4) The time space between the photosensor signals also helps find ____________ and ____________ locations

c. The microcomputer must also know the location of the read/write head in order to:

   1) Determine the ____________ and ____________ location of information on the disk, or the sector and track locations of information

   2) Determine ____________ locations by using signals generated as the hole in the disk passes over the photosensor/light combination

   3) Determine ____________ location by using informatin from the magnetic head that slides in and out across the disk and is traceable to 00 (zero-zero) track information

d. The microcomputer must also determine that the head has been properly placed down or ____________ onto the disk so that it can read/write or erase

5. Select true statements concerning how a microcomputer system uses a program from a disk by placing an "X" in the appropriate blanks.

_____a. The microcomputer is turned ON

_____b. The microcomputer boots up with ROM

_____c. As soon as the system boots up, the microcomputer must continue to operate in ROM or transfer control to the DOS program on disk

_____d. If control is transferred to the DOS program, the disk drive must be activated and that part of the DOS program necessary for full control of the system must be transferred into ROM

_____e. Once a DOS program is installed in RAM, programs stored on the disk are fully accessible within the limits of the program

TEST

6. Complete statements concerning control activities in floppy disk formatting by circling the word(s) that best completes each statement.

   a. The floppy disk must be inserted in the drive in the proper orientation so that the (**write-protect notch, index hole**) can be sensed by either a microswitch or a photosensor

   b. Improper disk orientation also stops the photosensor/light timing functions as the hole in the disk passes over it to determine (**track, RPM**) and sector locations

   c. After a disk is properly inserted, the door/latch must be closed so that the drive motor hub clamp will be centered and pulled down to firmly clamp the disk to the (**spindle motor, hub clamp**)

   d. Closing the drive door may also activate a switch that starts the (**spindle, stepper**) motor, but in some drives, the (**spindle, stepper**) is turning before the door is closed

   e. Closing of the drive door sends a signal back to the system to indicate that a disk has been inserted, that the door is closed, and that the disk is (**properly in place, spinning properly**)

   f. Since a door can be closed without inserting a disk, there is usually a (**microswitch, mechanism**) that detects the presence or lack of a disk

   g. The (**formatting control functions, system detectors**) serve to let the system know:

      1) That a disk has been properly inserted

      2) That the disk is properly clamped and rotating

      3) Whether or not the disk is write-protected

      4) That the photosensor/light is in proper relation to the spinning hole in the disk and that RPM and sector information are correct

7. Arrange in order typical steps in formatting a floppy disk by placing the correct sequence number in the appropriate blank.

   _____a. Once the format has been overlayed on the blank disk, the formatted disk will accept the application selected by the user

   _____b. The disk controller coordinates the disk drive information with information from the DOS and its appropriate formatting utility

   _____c. The formatting utility will:

      1) Read the disk to determine if there is information stored on the disk

      2) Inform the user by way of a CRT reading that the disk does contain information that will be destroyed during the formatting process

TEST

3) Upon user commands, erase existing information on a disk so that it will not interfere with the new storage format

4) Upon user command, overlay a magnetic storage format on the blank disk

______d. Signals to indicate proper disk insertion are sent from the disk drive to the disk controller via control lines

8. Select true statements concerning how tracks and sectors are selected by placing an "X" in the appropriate blanks.

______a. To read from or write to a disk, specific tracks and sectors must be located, and finding these locations is a function of the analog board

______b. The rotary drive motor that turns the spindle runs at a constant speed, usually 400 RPM

______c. After the disk is clamped to the spindle, the disk rotates under the read/write head as a sensor picks up the passing of hole in the disk

______d. The time frame space from sensor activity until the head arrives at the proper sector location is a timing function

______e. After sector location, the read/write head must be moved from its present location, which may or may not be at track 00, in or out to the proper track location

______f. Locating the proper track also requires that the read/write head be pulled down onto the disk, and this is accomplished with a head loading signal

______g. To read data once sector and track are located, the electronic system will be turned into a magnetic pickup similar to the pickup used with a tape recorder

______h. To write data once sector and track are located, the electronic system will send to the head a signal that creates a magnetic field

______i. The oxide surface of the disk is magnetized in one direction or the other with respect to polarity in order to create binary 1's and 0's on the oxide surface of the disk

______j. Each track/sector location is wide enough to accommodate a fairly large number of binary bits at a given density as the head moves across the sector

______k. Data is recorded across the sector because the sector location is a continuous activity that can have a variable number of locations

______l. Track location is a discrete function tied into the construction of the stepper-type head motor which permits any one of a given number of positions, and is also continuous

TEST

9. Match system detectors with their functions.

_____a. This microswitch or photosensor/lamp combination senses the presence or absence of a tab over the write protect notch

_____b. Usually a photosensor that is connected to the control system in such a way that it can inform the system if the head is or is not at track 00 because the track 00 reference is used for positioning the head correctly in other track locations

_____c. This photosensor/lamp combination sends out a signal each time the hole in the disk passes over it, and this speed and position information is a vital timing function

1. Index hole detector
2. Write-protect notch detector
3. Track 00 detector

10. Match electromechanical subsystem components with their functions.

_____a. Provides a rugged case to house the disk drive so that it will protect the drive from movement or warping that could put the head out of alignment

_____b. Causes the spindle to move when it is closed, centers the disk, and clamps the disk to maintain stability between the spindle and motor drive hub as the disk rotates

_____c. Usually a DC brushless motor designed to run at a fixed speed (usually 300 RPM) for a long operational life

_____d. A miniaturized version of a tape recorder head complete with an erase facility so it can read, write, or erase, and very light weight so it can move rapidly on the head carriage

_____e. The housing for the magnetic head, designed to move quickly along rails or tracks to position the head in a track location in response to a signal sent to a stepper motor

_____f. A spring loaded lifter mechanism controlled by a solenoid that caused the head to be pressed (loaded) against the oxide on the disk only when the disk drive is turned ON

_____g. A mechanical device tied in with the stepper motor that moves the carriage to designated track positions

1. Head carriage
2. Frame
3. Head position seek mechanism
4. Magnetic head
5. Door/latch mechanism
6. Head load mechanism
7. Rotary drive motor

TEST

11. Match electrical subsystems with their general functions.

______a. These are the reference signals for the binary 1's and 0's when writing to or reading from a disk

______b. These are the control signals for the DC brushless motors and the stepper motors used in disk drives, and they are designed to be directly interfaced with digital components

______c. Employs a highly sensitive amplifier that turns the read/write head into a sensitive detector that picks up the magnetically stored binary 1's and 0's and sends them along with synchronized timing information to the microcomputer

______d. Takes information from the microcomputer, synchronizes it with disk and head location, then generates magnetic signals across the head so that the oxide surface of the disk is polarized directionally as binary 1's or 0's

______e. Synchronizes and logically manages all read/write activities and reads signals from the detection devices

1. Write circuitry
2. Passive read circuitry
3. Digital signals
4. Control circuitry
5. Analog signals

12. Complete statements concerning specific control functions of the electrical subsystems by inserting the word(s) that best completes each statement.

a. Locating sectors by the position of the disk in relation to the ____________ hole

b. Locating tracks by the position of the head in relation to ____________ track

c. Activating the sense ____________ for reading from a disk

d. Activating the ____________ ____________ drivers required to produce the current for polarizing the oxide coating on the disk when writing to the disk

e. Reading signals from the ____________ devices

f. Providing ____________ control for the brushless ____________ motor that turns the spindle and rotates the disk

g. Providing ____________ ____________ control to operate the stepper motor

TEST

13. Complete statements concerning special tools recommended for repairing disk drives by circling the word(s) that best completes each statement.

    a. A small battery operated DC vacuum cleaner is recommended because an AC vacuum cleaner produces a magnetic field that could (**erase memory, damage a motor**)

    b. Canned compressed air or gas is recommended for cleaning because it will remove microscopic particles of contaminants without (**scratching, demagnetizing**) sensitive head components or leaving a residue

    c. Clean (**isopropol, wood**) alcohol, not methyl alcohol, is recommended for cleaning areas that cannot be brushed or cleaned with air

    d. Lint-free cleaning swabs or cleaning sticks with (**cotton, urethane foam**) tips are recommended cleaning tools for use with isopropol alcohol

    e. Precision oilers are recommended for (**disk drive spindles, guide rails**) and other areas where excess oil would be difficult to remove or where excess oil could damage a nearby component

    f. High quality machine oil (**may be, should not be**) used for general lubrication, but teflon-based oil is recommended for certain applications

    g. An aerosol spray contact cleaner is recommended for (**cable connectors and other contacts, PC boards**)

14. Select true statements concerning cable and connector trouble spots by placing an "X" in the appropriate blanks.

    _____a. In some cases, the 34-pin disk control connector can be put on upside down, and care should be taken when handling this connector

    _____b. The connectors that attach the printed circuit card(s) to the drive are delicate and must be handled with special care

    _____c. The connectors that attach the printed circuit card(s) to the drive must be replaced exactly and this may require sketching their arrangement before removal

    _____d. The cable from the disk controller out to the drive has several connectors on it, and the last connector on the cable is the terminator and requires special attention

    _____e. The terminator terminates the impedance of the drive and must be reinstalled in its original position

    _____f. The terminator looks like an IC an actually plugs into an IC socket and should be easy to locate by referencing a proper schematic

TEST

15. Select true statements concerning technical and graphic materials required for troubleshooting by placing an "X" in the appropriate blanks.

_____a. When original technical information is available from a disk drive or printer manufacturer, it should be referenced and followed carefully in all troubleshooting

_____b. OEM schematicas should always be referenced for troubleshooting, adjustments, and repairs, and if OEM schematics are not available, make intelligent guesses

_____c. A good technician should always keep notes of problems peculiar to specific disk drives and the troubleshooting techniques that are most suitable for the problems

_____d. When an error is discovered in technical information, send the manual back to the manufacturer

16. Complete a list of cost factors important in disk drive repair by inserting the word(s) that best completes each statement.

a. As the disk drive industry has improved manufacturing techniques, the cost of quality replacement disk drives has continued to ____________

b. Because of available low-cost replacements, repairing disk drives with certain problems can easily cost more than installation of a ____________ drive

c. Disk drive problems that would not be cost-effective to repair generally include:

1) A faulty ____________ motor

2) A faulty ____________/____________ head

3) Faulty ____________ or ____________ boards

4) A faulty ____________ motor

5) Obvious situations that indicate combinations of ____________ that would take extensive time to isolate and correct

TEST

17. Match typical diagnostic disk tests with their functions.

______a. Checks to see if the read/write head is centered directly over a given track location

______b. Checks to see if the drive rotates at specified RPM

______c. Checks to see if the system will hold a floppy disk firmly and accurately in place

______d. Checks to see if the drive will accurately record and then play back a random set of numbers

1. Disk speed test
2. Write/read test
3. Radial alignment test
4. Disk clamping test

18. Complete a list of guidelines for troubleshooting faulty disk drives by inserting the word(s) that best completes each statement.

a. ______________ the malfunction

b. Check all cables and connectors that can be checked without ______________

c. Try to boot the system with a ______________ disk

d. Try to run a ______________ disk

e. Begin in-depth troubleshooting only if the DOS or the diagnostic ______________ ______________ ______________

f. Start in-depth troubleshooting by checking for ______________ and ______________ on the power connector to the drive

g. ______________ the drive

h. ______________ the drive

i. Make ______________ adjustments

j. Make ______________ ______________ adjustments

k. Make a ______________ ______________ final disposition

(NOTE: If the following activities have not been accomplished prior to the test, ask your instructor when they should be completed.)

19. Demonstrate the ability to:

a. Validate a floppy disk drive failure. (Job Sheet #1)

b. Troubleshoot, clean, lubricate, and prepare a floppy disk drive for adjustments. (Job Sheet #2)

c. Adjust speed and align the head on a floppy disk drive. (Job Sheet #3)

SERVICING AND REPAIRING FLOPPY DISK DRIVES
UNIT V

ANSWERS TO TEST

1. a. 3
   b. 5
   c. 2
   d. 6
   e. 1
   f. 4

2. a. Structure
   b. Insert, handle
   c. Structure, functions
   d. Backup, backup
   e. Subsystems
   f. Formatting, writing to, reading from
   g. Systematic, cost-effective

3. a,c

4. a. 1) ON
      2) Inserted
      3) Closed, rotate
   b. 1) Specific
      2) Penetrates
      3) Signal
      4) Sector, track
   c. 1) In, out
      2) Sector
      3) Track
   d. Loaded

5. a,b,c,d,e

6. a. Write-protect notch
   b. RPM
   c. Spindle motor
   d. Spindle, spindle
   e. Properly in place
   f. Mechanism
   g. Formatting control functions

7. a. 4
   b. 2
   c. 3
   d. 1

8. c,d,e,f,g,h,i,j,k

ANSWERS TO TEST

9. a. 2
b. 3
c. 1

10. a. 2
b. 5
c. 7
d. 4
e. 1
f. 6
g. 3

11. a. 3
b. 5
c. 2
d. 1
e. 4

12. a. Index
b. 00
c. Amplifiers
d. High current
e. Detection
f. DC, DC
g. Four-phase

13. a. Erase memory
b. Scratching
c. Isopropol
d. Urethane foam
e. Disk drive spindles
f. May be
g. Cable connectors and other contacts

14. a,b,c,d,e,f

15. a,c

16. a. Drop
b. Replacement
c. 1) Drive (or stepper)
 2) Read/write
 3) Digital, analog
 4) Stepper (or drive)
 5) Malfunctions

17. a. 3
b. 1
c. 4
d. 2

ANSWERS TO TEST

18.
  - a. Validate
  - b. Disassembly
  - c. DOS
  - d. Diagnostic
  - e. Will not run
  - f. +5V, +12V
  - g. Clean
  - h. Lubricate
  - i. Timing
  - j. Head alignment
  - k. Cost-effective

19. Performance competencies evaluated according to written procedures in the job sheets

NOTICE

STAFF MEMBERS AND TECHNICAL ADVISORS HAVE WORKED TO MAKE THESE INSTRUCTIONAL MATERIALS EASY TO USE AND EASY TO READ. WE WELCOME YOUR INPUT IN THE FORM OF SUGGESTIONS AND/OR CORRECTIONS BY RETURNING THE ATTACHED POSTCARD WHICH HAS BEEN PRE-PAID.

THANK YOU.

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My overall rating of this publication is:

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Other comments __________________________________

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